"ALIS VOLAT PROPRIIS."

FIFTH BIENNIAL REPORT

OF THE

BOARD OF HORTICULTURE

TO THE

TWENTIETH LEGISLATIVE ASSEMBLY

OF THE

STATE OF OREGON

1898

SALEM, OREGON
W. H. LEEDS, STATE PRINTER
1898.

BATTLESHIP "OREGON."

The "Oregon," our mightiest terror of high seas, and Spanish fleet, ranks as a first class battleship of 9,000 indicated horse power, 10,288 tons displacement, but she has a speed of only 15 knots, the least with which any of our battleships are credited. Her cost was $3,180,000, to which a further sum of $2,500,000 must be added for her equipment. Her main battery consists of four 13-inch, eight 8-inch, and six 4-inch breech-loading rifles; her secondary battery comprises twenty 6-pounders rapid-fire, six 1-pounder rapid-fire, and four Gatling guns—two mounted on her superstructure deck, and two in her fighting tops—in all, 46 guns, capable of hurling projectiles ranging in weight from 1 pound to 1,100 pounds, to handle which she carries a crew of 441 men and 32 officers. Captain, Charles E. Clark.

TO THE FRUIT-GROWER.

This report is sent to you with the compliments of the board, trusting you may find something of personal interest to you.

For further information, kindly address the commissioner of your district, who will cheerfully answer all communications appertaining to horticultural matter, and who will also visit you, and neighbors, if you so desire.

The commissioner of your district will deem it a special favor if you will inform him of any orchards in your neighborhood which are infected, and the owners thereof counseled with, in order to cleanse and eradicate any insects on their premises.

In order to avoid confusion and simplify matters, we have given only such sprays as we have found by personal experiments to be of any value and yet cover all insects and fungous diseases known to exist in Oregon.

OFFICERS OF THE BOARD.

DR. J. R. CARDWELL,	PRESIDENT
HENRY E. DOSCH,	TREASURER
JOHN MINTO,	SECRETARY

OFFICE, STATE HOUSE, SALEM, OREGON.

BOARD OF COMMISSIONERS.

STATE AT LARGE.

J. R. CARDWELL, - - - - - - - - - - Portland

FIRST DISTRICT.

HENRY E. DOSCH, - - - - - - - - - - Hillsdale

SECOND DISTRICT.

L. T. REYNOLDS, - - - - - - - - - - - Salem

THIRD DISTRICT.

J. R. CASEY, - - - - - - - - - - - - - Ashland

FOURTH DISTRICT.

EMILE SCHANNO, - - - - - - - - - - The Dalles

FIFTH DISTRICT.

GEORGE A. HOBBS, - - - - - - - - Freewater

DISTRICT BOUNDARIES.

FIRST DISTRICT.

Multnomah, Clackamas, Yamhill, Washington, Columbia, Clatsop and Tillamook counties.

SECOND DISTRICT.

Lincoln, Marion, Polk, Benton, Linn and Lane counties.

THIRD DISTRICT.

Douglas, Jackson, Klamath, Josephine, Coos, Curry and Lake counties.

FOURTH DISTRICT.

Morrow, Wasco, Gilliam, Crook and Sherman counties.

FIFTH DISTRICT.

Umatilla, Union, Baker, Wallowa, Malheur, Grant and Harney counties.


GOLD, SILVER, COPPER, IRON, COAL, ZINC, LEAD.
PEACE-HATH-HER-VICTORIES-AS-WELL-AS-WAR.
NEW YORK
ILLINOIS
WISCONSIN
NORTH CAROLINA
GEORGIA
CANADA
MEXICO
SCANDINAVIA
SWITZERLAND
ITALY
FRANCE
AUSTRIA
TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.
DIPLOMA
FOR
Gold Medal
Awarded
To State of Oregon
For Fresh Fruits grown in Oregon

HORTICULTURAL LAW

AS PASSED BY THE LEGISLATURE, FEBRUARY, 1895.

An Act to amend an act entitled "An act to create a state board of horticulture and appropriate money therefor," approved February twenty-fifth, eighteen hundred and eighty-nine, and an act amendatory thereof entitled "An act to amend an act entitled 'An act to create a state board of horticulture and appropriate money therefor,' approved February twenty-fifth, eighteen hundred and eighty-nine," approved February twenty-first, eighteen hundred and ninety-one, and to protect the horticultural industry in Oregon.

Be it enacted by the legislative assembly of the state of Oregon:

Section 1. There is hereby created a board of horticulture, to consist of six members, who shall be appointed by a board, consisting of the governor, secretary of state, and state treasurer. One member of the said board of horticulture shall represent the state at large, and one member shall be appointed to represent each of the five districts as hereby created, to-wit, provided that the commissioner at large shall not receive any pay for his services:

First—The first district, which shall comprise the counties of Multnomah, Clackamas, Yamhill, Washington, Columbia, Clatsop and Tillamook.

Second—The second district, which shall comprise the counties of Marion, Polk, Benton, Lincoln, Linn and Lane.

Third—The third district, which shall comprise the counties of Douglas, Jackson, Klamath, Josephine, Coos, Curry and Lake.

Fourth—The fourth district, which shall comprise the counties of Wasco, Sherman, Morrow, Gilliam and Crook.

Fifth—The fifth district, which shall comprise the counties of Umatilla, Union, Wallowa, Baker, Malheur, Harney and Grant.

Section 2. The members shall reside in the districts for which they are respectively appointed. They shall be selected with reference to their knowledge of and practical experience in horticulture and the industries connected therewith. They shall hold office for the term of four years, and until their successors are appointed and have qualified; but the members

of said board now in office shall hold office till the expiration of the term for which they were appointed.

Section 3. Said board shall employ from without their number a secretary, who shall exercise the powers and discharge the duties conferred upon him by this act and whose compensation shall not exceed seventy-five dollars per month, to be paid in the same manner as other state officers. Said board shall also elect from their own number a treasurer, who shall give a bond to the governor of the state of Oregon in the sum of ten thousand dollars, conditioned upon the faithful discharge of his duties. Before entering upon the discharge of his duties, each member of the board shall make and subscribe an oath to support the constitution of the United States and of the state of Oregon, and to diligently, faithfully, and impartially discharge the duties of his office, which said oaths shall be filed with the secretary. The secretary shall make and subscribe a like oath, which shall be filed with the treasurer of the board.

Section 4. The board may receive, manage, use, and hold donations and bequests of money and property for promoting the objects of its formation. It shall meet on the second Mondays of April and October of each year, and as much oftener as it may deem expedient for consultation and for the adoption of those measures which will best promote the horticultural industries of the state. It may, but without expense to the state, select and appoint competent and qualified persons to lecture in each of the districts named in section 1 of this act, for the purpose of encouraging and improving practical horticulture, and of imparting instruction in the best methods of treating the diseases of fruits and fruit trees, cleansing orchards and exterminating insect pests.

Section 5. The office of the board shall be located in such place as a majority thereof may determine. It shall be kept open to the public, subject to the rules of the board, every day, excepting Sundays and legal holidays, and shall be in charge of the secretary during the absence of the board.

Section 6. For the purpose of preventing the introduction into the state or spread of contagious diseases, insects, pests, or fungous growths among fruit or fruit trees, and for the prevention, treatment, cure and extirpation of fruit pests, and diseases of fruit and fruit trees, and for the disinfection of grafts, scions, orchard debris, fruit boxes and packages, and other material or transportable articles dangerous to orchards, fruit or fruit trees; said board may make regulations for the

quarantining, inspection and disinfection thereof, which said regulations shall be circulated by the board in printed form among the fruit-growers and fruit-dealers of the state, shall be published at least four successive times in some daily or weekly paper in each county in the state before the same shall be in force therein, and shall be posted in three conspicuous places in each county in the state, one of which shall be at the county courthouse. Such regulations, when so promulgated, shall be held to import notice of their contents to all persons within the state, and shall be binding upon all persons therein. A wilful violation of any quarantine or other regulation of said board, necessary to prevent the introduction into the state, or the shipment, sale or distribution of any article so infected as to be dangerous to the fruit-growing interest of the state, or the spread of dangerous diseases among fruit trees or orchards, shall be deemed a misdemeanor, and on conviction thereof shall be punished by a fine of not less than five nor more than one hundred dollars for each offense, or by fine and imprisonment, not less than five nor more than thirty days.

Section 7. It shall be the duty of the several members of the board, and the secretary under their direction, to visit their respective districts and to see that all regulations of the board and all provisions of law to prevent the introduction or spread of fruit pests and diseases of trees or plants injurious to the horticultural interests of the state are enforced. Any member of the board, or the secretary thereof, shall forthwith, upon the complaint of interested parties, inspect orchards, nurseries, and other places suspected to be infested with fruit pests or infected with contagious diseases injurious to trees, plants or fruits. If, upon report of any member or the secretary, the board shall be of the opinion that any locality, district, orchard or place is infested with fruit pests or infected with contagious diseases, or injurious to trees, plants or fruits, and liable to spread to other orchards or localities to their damage or injury so as to be a public danger, said board shall, by an order entered upon its minutes, declare such place to be under quarantine, and shall give notice thereof by posting a notice in writing in a conspicuous place upon the premises, specifying with convenient certainty what place or premises are under quarantine regulations, and by delivering a copy of such notice to the owner or person in charge of the premises, if he may be found thereon; and such place shall thereafter be subject to quarantine regulations of the board.

and violation thereof shall be punishable as hereinbefore provided. As soon as, in the opinion of any member of the board or the secretary thereof, the danger from such quarantine locality shall have ceased, he may suspend the said quarantine, and shall immediately report the fact to the board, who may confirm such action or may re-establish the said quarantine, in which case it shall not be again suspended but by action of the board.

Section 8. The board, and, in case of necessity during the recess of the board, the member residing in the quarantined district, or the secretary, may appoint such quarantine guardian as may be needed to carry out the provisions of this act, whose duty it shall be to see that the regulations of the board and the instructions of the secretary are enforced and carried out. They shall also report to the board all infractions or violations of said regulations or the law in regard to quarantining, disinfection and destruction of pests. The salary of quarantine guardians shall be fixed by the board at not to exceed two dollars per day, and shall be paid by the owners of orchards or other places under quarantine, and they may maintain an action therefor before any justice of the peace in any district in which any quarantined locality is wholly or in part located; but in no case shall they have any claim upon the state for such services.

Section 9. The powers conferred in the two preceding sections of this act shall be exercised only in great and imminent danger to the fruit interests of the state, and with the utmost caution and regard for the rights of individuals affected, consistent with the safety and welfare of the fruit interests of the whole state.

Section 10. It shall be the duty of the several members of the board, and of the secretary, under their direction, whenever they shall deem it necessary, to cause an inspection to be made of any orchards, nurseries, trees, plants, vegetables, vines, or any fruit packing-house, storeroom, salesroom, or any other place within their districts, and if found infested with any pests, diseases or fungous growths injurious to fruits, plants, vegetables, trees or vines, or with their eggs or larvæ, liable to spread to other places or localities, or such nature as to be a public danger, they shall notify the owner or owners, or persons in charge of or in possession of such articles, things or places, that the same are so infested, and shall require said persons to eradicate or destroy said insects or pests, or their eggs or larvæ, or to treat such contagious diseases

within a certain time, to be specified in said notice. Said notices may be served upon the person or persons, or any of them, owning, having charge or having possession of such infested place, article or thing, by any member of the board, or by the secretary thereof, or by any person deputed by the said board for that purpose, or they may be served in the same manner as a summons in an action at law Such notice shall contain directions for the application of some treatment approved by the commissioners for the eradication or destruction of said pests, or the eggs or larvæ thereof, or the treatment of contagious diseases or fungous growths. Any and all such places, orchards, nurseries, trees, plants, shrubs, vegetables, vines, fruit or articles thus infested are hereby declared to be a public nuisance; and whenever any such nuisance shall exist at any place in the state on the property of any owner or owners upon whom or upon the person in charge or possession of whose property notice has been served as aforesaid, and who shall have failed or refused to abate the same within the time specified in such notice, or on the property of any nonresident, or any property not in the possession of any person and the owner or owners of which cannot be found by the resident member of the board or the secretary, after diligent search within the district, it shall be the duty of the board, or the members thereof in whose district said nuisance shall exist, or the secretary under his or their direction, to cause such nuisance to be at once abated, by eradicating or destroying said insects or pests, or their eggs or larvæ, or by treating or disinfecting the infested or diseased articles. The expense thereof shall be a county charge, and the county court shall allow and pay the same out of the general fund of the county. Any and all sums so paid shall be and become a lien on the property and premises from which said nuisance shall have been removed or abated, in pursuance of this act, and may be recovered by a suit in equity against such property or premises; which suit to foreclose such liens shall be brought in the circuit court of the county where the premises are situated, by the district attorney, in the name and for the benefit of the county making such payments. The proceedings in such cases shall be governed by the same rules, as far as may be applicable, as suits to foreclose mechanics' liens, and the property shall be sold under the order of the court, and the proceeds applied in like manner. The board is hereby invested with the power to cause such nuisances to be abated in a summary manner.

Section 11. It shall be the duty of the secretary to attend

all meetings of the board, and to preserve records of the proceedings, correspondence and actions of the board, to collect books, pamphlets, periodicals, and other documents, containing valuable information relating to horticulture, and to preserve the same; to collect statistics and general information showing the actual condition and progress of horticulture in this state and elsewhere; to correspond with agricultural and horticultural societies, colleges and schools of agriculture and horticulture, and such other persons and bodies as may be directed by the board, and prepare, as required by the board, reports for publication.

Section 12. The board shall, biennially, in the month of January, report to the legislative assembly a statement of its doings, with a copy of the treasurer's reports for the two years preceding the session thereof. The members shall receive as compensation their actual expenses while engaged upon the work of the board or the enforcement of the provisions of this act, and shall be allowed three dollars a day for the time actually employed.

Section 13. The treasurer shall receive all moneys belonging to the board and pay out the same only for bills approved by it, and shall render annually to the board a statement in detail of all receipts and disbursements.

Section 14. There is hereby appropriated for the uses of the state board of horticulture, as set forth in this act, the sum of four thousand five hundred dollars for the year beginning January first, eighteen hundred and ninety-five, and the sum of four thousand five hundred dollars for the year beginning January first, eighteen hundred and ninety-six, out of any moneys in the state treasury not otherwise appropriated, and the secretary of state shall draw his warrant in favor of the treasurer of the board for said sum upon the state treasurer.

Section 15. That the fruit and horticultural interests of this state being in urgent need of the protection afforded by this act, an emergency exists, and this act shall take effect from and after its approval by the governor.

Passed by the house February 11, 1895.

CHARLES B. MOORES,
Speaker of the house.

Passed by the senate February 15, 1895.

JOSEPH SIMON,
President of the senate.

Approved February 23, 1895.

WILLIAM P. LORD,
Governor.

QUARANTINE REGULATIONS.

At a special meeting of the Oregon state board of horticulture, held in Portland, April 2, 1895, all members present, the following regulations were adopted, in accordance with the laws regulating such matters, and are, therefore, binding upon all persons: —

Rule 1. All consignees, agents or other persons, shall, within twenty-four hours, notify the quarantine officer of the state board of horticulture, or a duly commissioned quarantine guardian, of the arrival of any trees, plants, buds or scions at the quarantine station in the district of final destination.

Rule 2. All trees, plants, cuttings, grafts, buds or scions imported or brought into the state from any foreign country, or from any of the states or territories, are hereby required to be inspected upon arrival at the quarantine station in the district of final destination, and if any such nursery stock, trees, plants, cuttings, grafts, buds or scions are found to be free of insect pests and fungous diseases, the said quarantine officer or duly commissioned quarantine guardian shall issue a certificate to that effect. And, furthermore, if any of said trees, plants, cuttings, grafts, buds or scions are found infested with insect pests, fungi, blight or other diseases injurious to fruit or to fruit trees, or other trees or plants, they shall be disinfected and remain in quarantine until the quarantine officer of the state board of horticulture or the duly commissioned quarantine guardian can determine whether the said trees, plants, cuttings, grafts, buds or scions are free from live injurious insect pests or their eggs, larvæ or pupæ or fungous diseases before they can be offered for sale, gift, distribution or transportation. All persons or companies are hereby prohibited from carrying any trees, plants, cuttings, grafts, buds or scions from without the state to any point within the state beyond the nearest point on its line or course to the quarantine station in the district of ultimate destination; or from any point within the state to any other point therein, until such trees, plants, cuttings, grafts, buds or scions have been duly inspected, and, if required, disinfected as hereinbefore provided; and all such shipments must be accompanied by the

proper certificate of the inspecting officer; *provided, however,* that after such persons or company have given the proper officer four days' notice, he or they shall not be required to hold such shipments further, without directions from such officer.

Rule 3. All peach, nectarine, apricot, plum or almond trees, and all other trees budded or grafted upon peach stocks or roots, all peach or other pits, and all peach, nectarine, apricot, plum or almond cuttings, buds or scions raised or grown in a district where the "peach yellows" or the "peach rosette" are known to exist, are hereby prohibited from being imported into or planted or offered for sale, gift or distribution within the state of Oregon.

Rule 4. All trees, plants, cuttings, grafts, buds, scions, seeds or pits arriving from any foreign country found infested with insect pests or their eggs, larvæ or pupæ or with fungi, or other disease or diseases hitherto unknown in this state, are hereby prohibited from landing.

Rule 5. Fruit of any kind grown in any foreign county, or in any of the states or territories, found infested with any insect or insects, or with any fungi, blight or other disease or diseases injurious to fruit or fruit trees, or to other trees or plants, is hereby prohibited from being offered for sale, gift or distribution within the state.

Rule 6. Any boxes, packages, packing material and the like infested by any insect or insects, or their eggs, larvæ or pupæ or by any fungi, blight or other disease or diseases known to be injurious to fruit or to fruit trees, or to other trees or plants, and liable to spread contagion, are hereby prohibited from being offered for sale, gift, distribution or transportation until said material has been disinfected by dipping it in boiling water and allowing it to remain in said boiling water not less than two minutes; such boiling water used as such disinfectant to contain in solution one pound of concentrated potash to each and every ten gallons of water.

Rule 7. All trees, plants, grafts, cuttings, buds or scions may be disinfected by dipping in a solution of three fourths of a pound of whale-oil soap (eighty per cent.) to each and every gallon of water; said whale-oil soap solution shall be kept at a temperature of one hundred to one hundred and fifteen degrees. Said trees, plants, cuttings, grafts, buds or scions shall remain in said solution not less than two minutes. After said trees, plants, cuttings, grafts, buds or scions have been disinfected they shall remain in quarantine fourteen days, unless otherwise directed by the inspecting officer, for

subsequent inspection, and if deemed necessary by the quarantine officer of the state board of horticulture, or a duly commissioned quarantine guardian, for further disinfection.

Rule 8. All trees, plants, cuttings, grafts, buds or scions may be disinfected by fumigation with hydrocyanic acid gas, as follows: Said trees, plants, cuttings, grafts, buds or scions shall be covered with an air-tight tent or box, and for each and every one hundred cubic feet of space therein, one ounce of C. P. cyanide of potassium (ninety-eight per cent.), one fluid ounce of sulphuric acid, and two fluid ounces of water shall be used. The cyanide of potassium shall be placed in an earthenware vessel, the water poured over the said cyanide of potassium, afterward adding the sulphuric acid, and the tent or box to be immediately closed tightly, and allowed to remain closed for not less than forty minutes. After said trees, plants, cuttings, grafts or scions have been treated with hydrocyanic acid gas, as above directed, they shall remain in quarantine for fourteen days, unless otherwise directed by the inspecting officer, for subsequent inspection, and if deemed necessary by a member of the state board of horticulture, or the quarantine officer of said board, or a duly commissioned quarantine guardian, for subsequent disinfection.

Rule 9. All trees, plants, cuttings, grafts, buds or scions imported or brought into the state shall be inspected upon arrival at the quarantine station in the district of final destination, and if found infested with any injurious insects or diseases which cannot be destroyed by the remedies required in rules seven and eight of these regulations, are hereby prohibited from being planted or offered for sale, gift or distribution, and shall be proceeded against as a nuisance.

Rule 10. If any person or persons having in their possession trees, plants, cuttings, grafts, buds, scions, seeds or pits infested with an insect or insects, or with any fungi, blight or other disease or diseases injurious to fruit trees, or to any other trees or plants, shall refuse or neglect to disinfect the said trees, plants, cuttings, grafts, buds, scions, seeds or pits as is required by rules seven and eight of these regulations, after having been notified to do so by a member of the state board of horticulture, the quarantine officer of said board or a duly commissioned quarantine guardian, the said trees, plants, cuttings, grafts, buds, scions, seeds or pits shall be declared a public nuisance, and shall be proceeded against as provided by law.

Rule 11. Animals known as flying fox, Australian or

English wild rabbit, or other animals or birds detrimental to fruit or fruit trees, plants, etc., are prohibited from being brought or landed in this state, and, if landed, shall be destroyed.

Rule 12. Quarantine stations: —

For the first district, comprising the counties of Multnomah, Clackamas, Yamhill, Washington, Columbia, Clatsop and Tillamook, shall be Portland. Henry E. Dosch, quarantine officer, or any member of the board or the secretary thereof.

For the second district, comprising the counties of Marion, Polk, Benton, Linn, Lincoln and Lane, shall be Salem. Charles L. Dailey, quarantine officer, or any member of the board or the secretary thereof.

For the third district, comprising the counties of Josephine, Coos, Curry, Douglas, Jackson, Lake and Klamath, shall be Ashland. J. R. Casey, quarantine officer, or any member of the board or the secretary thereof.

For the fourth district, comprising the counties of Morrow, Wasco, Gilliam, Crook and Sherman, shall be The Dalles. Emile Schanno, quarantine officer, or any member of the board or the secretary thereof.

For the fifth district, comprising the counties of Umatilla, Union, Baker, Wallowa, Malheur, Grant and Harney, shall be Milton and Pendleton. G. A. Hobbs, quarantine officer, or any member of the board or the secretary thereof.

At all stations such other quarantine officers as may be from time to time appointed by the board, notice whereof will be given, and complete lists of whom may be obtained from the secretary or any member of the board.

Rule 13. Importers or owners of nursery stock, trees or cuttings, grafts, buds or scions desiring to have such nursery stock, trees, plants, cuttings, grafts, buds or scions inspected at points other than regular quarantine stations may have such inspection done where required; *provided, however*, that such importers shall pay all charges of inspection; such charges and expenses to be paid before a certificate is granted. Transportation companies or persons and consignees or agents shall deliver and cause to be detained all nursery stock, trees, plants and fruit at one or other of the quarantine stations, for inspection, as provided by the rules and regulations of the board.

Rule 14. The fee for the inspection of apple, pear, plum, peach, nectarine, prune, cherry, apricot, nut-bearing trees and all other trees, shrubs or plants shall be as follows: Thirty

cents per hour, including the time from leaving home, inspection and return home of the inspector, and actual traveling and other expenses. On all fruits, the fee for inspection shall be one dollar on any sum up to thirty-five dollars, and two dollars on any sum over that amount, and five dollars for carload lots.

Rule 15. All persons growing nursery stock, trees and plants for sale, or to be offered for sale, are hereby required to report to the commissioner of the district in which said nursery stock, trees or plants are grown for inspection during the months of September, October or November of each and every year; and the commissioner of such district, or his duly appointed deputy, shall inspect such nursery stock, trees or plants prior to shipment and delivery. When said nursery stock, trees or plants are found by said inspecting officer to be worthy of a certificate setting forth the freedom of such nursery stock, trees or plants from live injurious insect pests, their eggs, larvæ, pupæ or fungus diseases, the said inspecting officer shall then issue to the owner or owners of said nursery stock, trees or plants a certificate of inspection. The condition under which this certificate is granted is, that the party or parties receiving such certificate shall be compelled to disinfect by fumigation with hydrocyanic acid gas, as described in rule eight, all pear and apple trees or other stock grown on apple roots, after lifting the same and before delivery to purchaser or carriers; and in case said fumigation is neglected, said certificate of inspection shall be void and of no effect.

Passed at a meeting of the state board of horticulture at Portland, Oregon, April third, eighteen hundred and ninety-five, and amended at a regular meeting of the state board of horticulture at Salem, October fifteenth, A. D. eighteen hundred and ninety-five.

J. R. CARDWELL,
President.

Attest: JOHN MINTO,
Secretary.

ORCHARD QUARANTINE REGULATION.

Referring to affected orchards and home places, see sections seven and eight of the horticultural law, which will be applied in such cases.

REPORT OF THE PRESIDENT.

To the honorable state board of horticulture :

Nearly eight years' work in the orchards of Oregon as inspectors of fruit pests and teachers of horticulture should bear some creditable evidence in improved methods and a material advance in the fruit industry, and should settle the question of the usefulness or necessity of this board, else the appropriation by the state legislature for this work should be stopped and this board abolished; we submit that it is the sense of every member of the board that we make this issue, and that we will abide most cheerfully by a fair-minded decision of the fruit-growers.

As president of the board and commissioner at large, I confidently invite the closest scrutiny of the work of each individual commissioner. I do this in the firm conviction that it will be found that the work assigned is in competent hands and has been faithfully and honestly performed and conscientiously reported, and that not one dollar of this fund has been dissipated in extravagant fees or useless expenditure, nor has been misappropriated; after nearly eight years of experience the work has been systematized; reports are made quarterly, attested under oath, and filed with our secretary and in the office of the secretary of state, where every interested inquirer and fruit-grower may see the number of orchards inspected in each district, the number of acres in each orchard, the number of trees of the different varieties grown, age, condition of trees, cultivation, pests found, if any, and remedies used or suggested with notes and remarks which will be of interest to the student of horticulture now, and to those who may come after us, forming a veritable history of the horticulture of the state today.

The fund provided has been insufficient to publish our reports for gratuitous distribution, or to do all the inspecting and educational work that should have been done. An equal apportionment of four hundred dollars per annum has been

allotted to each district. The sum of three dollars per day allowed by the act has limited the amount of work to one annual visit to the nurseries and the principal orchards. Not all the orchards could be inspected over the large territory comprising a district with the limited means for this fund. The inspector is now in most cases cordially welcomed as a helpful co-worker; the attitude of the orchardist is no longer suspicious, unfriendly and antagonistic as was so often the case in the beginning of the work. It is now recognized that the commissioner is familiar with the insect and fungus pests that infect the orchard and would only do a friendly act in pointing them out and advising the remedies for their extermination, make timely suggestions and give information in the best orcharding methods to secure the best marketable fruits; this helpful information is gratefully received and highly appreciated, in striking contrast to the threatened shotgun reception of the first years of the commission.

We believe it has been a misfortune to the fruit-growers of Oregon that the last report, including bulletins and pertinent matter compiled in eighteen hundred and ninety-five, could not have been published for gratuitous distribution. A resolution to publish five thousand copies passed by both branches of the legislature was abstracted by some unfriendly hand, not properly engrossed, and failed to become a law, hence was inoperative. By the few who received copies published for the legislative bodies it was pronounced our best report, and a valuable one, and has been widely called for. The five thousand copies asked should have been published and would have greatly lightened the work of this commission and substantially advanced the interests of horticulture. Five thousand copies of Bulletin Number Nine, and the legal requirements for notices published in the newspapers of the state entirely exhausted the fund set apart for printed matter.

To the newspapers of the state the board tender thanks and grateful acknowledgments for words of encouragement and valuable services rendered in aiding the commissioners and sustaining the work of the board. These favors were most timely, and highly appreciated.

Throughout the state there has been a most noticeable advance in orchard cultivation and methods of exterminating insect and fungus pests, so that now these are not considered the threatening scourge of former years. Every intelligent orchardist is familiar with the spray pump and other

appliances, and the most approved applications used as remedies. Like progress is apparent in the handling, packing and marketing fruits.

The study of the parasites of the insect pests has opened up a very interesting and hopeful field of scientific research and speculation. It is now known that every pest with which we are familiar is preyed upon and becomes the food of other insects—our veritable friends—and in the end are practically exterminated.

The family of aphides, heretofore most threatening to the fruit industry, in the woolly aphis *(Schizoneura)* and green aphis *(Aphis mali)*, are disappearing in many localities before the rapidly increasing army of ladybugs *(Chilocurus)*, a small beetle. A numerous genera of these are found in Oregon, to which the board has added by importation from California the *Vedalia cardinalis* and others. The twice-stabbed ladybird *(Chilocorus bivalnerus)*, a native variety, now very numerous and widely distributed, is doing most effective service.

A numerous genera of these little friends of the fruit-grower are found in Oregon, to which the board has added by importation from California the *Vedalia cardinalis*, which has done such effective service in California in exterminating the San Jose scale, now no longer dreaded as a pest in that state. This beetle has already proved a valuable acquisition to this state.

Careful observation suggests the thought that the introduction of friendly parasites or the cultivation of those native to the country will prove the most economical and practical solution of the problem of orchard pests. Abundance of food furnish the conditions necessary to the wonderfully prolific increase of these little friends to the orchardist, which will lead in the end to the extermination of the pests. This is not to say that there will not be times when the San Jose scale, green and woolly aphis, codlin moth, grasshoppers and other destructive enemies must be met intelligently and effectively with the spray pump and other devices; always not forgetting, inasmuch as possible, to guard and protect the friendly parasites.

The introduction into California of the *Vedalia cardinalis*, the enemy of the scale family, by Mr. Koebele has been worth millions of dollars to that state, and, as we are informed, has practically destroyed the scale family.

The many varieties of these helpful coworkers we now have will prove equal to the emergency in time, as we verily believe.

The history of the oyster-shell bark louse in the Willamette valley, well remembered by the pioneer fruit-grower, is an illustration in point. This scale had for years literally covered the fruit tree, which showed the effect in a stunted, sickly growth and inferior fruit. The spraying outfit and bulletin was not yet. A few trees had been washed with concentrated lye or whale-oil soap, with some benefit, but the applications were not sufficiently thorough to entirely eradicate. During the year 1862 this scale was at its worst. In the apple orchards of Seth Lewelling and J. H. Lambert we examined trees and found the growth of the last year coated; not an inch of new wood was free, but the parasitic enemy had come; and one or two years later not a bark louse could be found in the Willamette valley, and it has not troubled us since.

The San Jose and cottony-cushioned scale in many districts of California has a like history, and has entirely disappeared. With our present knowledge it would be too much to say just when we may lay aside the spray pump and trust to nature's kindly work to solve the problem of orchard pests. The time may come when we can do so; meanwhile, we can have clean, healthy orchards, and abundant fruit of superior quality by an intelligent use of the remedies given in the bulletin.

In February, 1853, as happens occasionally in these latter days after the warm winter rains and occasional sunshine, the rise of sap swelled the fruit buds and started our trees into growth, the weather turned cold enough to freeze the sap and stop circulation. This lasted several days; the warm afternoon sun was too sudden a change of temperature; some young trees died, and many were sun-scalded on the southwest side. The bark was entirely loosened and burst open in others; trees thus affected all died. The white sapwood *(cambium)* in all young trees turned a light brown. Nearly all started to grow in the spring; a few of these died during the season of what we now call sour sap. Apples showed what we now call deadspot, and stone fruit gummed, particularly cherries. This was precisely what we now call gummosis. The remedy then for this was to split the bark and give free vent to the exuding gum, and in bad cases to cut back the tops one half or more; most trees thus treated entirely recovered from deadspot and gummosis, and made vigorous and healthy growth. We had no green or woolly aphis then. Often in olden times we said our trees took cold and in the following growing season exuded gum, and occasionally we lost cherry trees, the Royal Anne being most affected. Those not dying the first year, however,

entirely recovered under treatment. In the winter of 1879 and 1880, after a warm season, the thermometer fell below zero, with results just mentioned, all over the valley. In my own young orchard, near Portland, more than half the trees were sun-scalded, some burst open and the sapwood in all turned dark; only five per cent. were lost and today the remainder bear no signs of the damage, and have made vigorous and healthy growth. The question arises, are not the microscopic germs and fungi growths supposed to be the cause of deadspot, crater-blight, gummosis, etc., results of the injury thus done, and a consequent weakened vitality from the climatic causes just stated? Does not the remedy of airating and warming the soil by underdrainage and thus preventing standing water about the roots in the wet season suggest itself as a preventive of this copious and untimely flow of sap, and untimely winter growth, which it is believed has much to do with all the damaged conditions to trees just noted? Commissioner Schanno reports that the pine forests in his district, heretofore badly infected with pine leaf-scale, has been almost entirely cleaned by the twice-stabbed ladybird, which this season had so multiplied that one might have collected them by the pint in their hiding places under loose bark and in hollow logs. Almost immediately after the disappearance of the scale this beetle either migrated to other infected quarters or died out for want of food.

The forests of Eastern Oregon and Washington have just now, to us, a new pest infecting the fir and pine,—a caterpillar of the white butterfly lately seen in this vicinity; in some localities trees stand leafless,—but as must have happened many times before in the more than thousand years these trees have withstood all enemies, the caterpillar must give place to some more beneficent form of life which surely follows it.

This brings up the thought that there has been much apprehension among some of our horticulturists about the denudation of our forests by lumbermen, fires and other causes.

The disastrous effect to the horticulture of the state from the wholesale denuding of our forest's area has been the subject of grave concern. After forty-four years of observation and some study of the subject, I am inclined to think these forebodings not well founded, and now have a word of encouragement, not taking into account government forest reserves, or state aid, however valuable adjuncts these might prove, which we leave for future discussion and consideration. The conditions of our western coniferous forests are very

different from the decideous hardwood forests of the continent. Our moist climate, the lightwinged seeds of the conifers borne for miles in the air, the wonderful prepotency of the Douglas fir *(Pseudotsuga taxifolia)* in holding its ground and extending its area. This is well illustrated in the Willamette valley, and if we may judge the future by the past, there need be no fear about the conservation or increase of our timber lands, and the consequent favorable equable temperature, rainfall, watershed, etc.

The wooded area of this country, despite devastating fires, the extensive clearings for homes and agricultural purposes, has not decreased in Oregon within the memory of the pioneer. To the contrary, there has been a notable reforesting of vast districts of old mountain burns, hundreds of miles in extent, now in striking contrast to the bald hills and tangled log heaps of forty years ago. The foothills and valleys are encroached upon by young fir forests, twenty to fifty years old. Standing on Mary's Peak, in Benton county, in the fall of 1853, looking westward sixty miles or more to the ocean, there was scarcely a green tree within the range of vision,—a glass revealed hundreds of miles of burned and fallen timber, not a living tree or shrub to rest the eye upon,—truly a scene of desolation. Late surveys report this county covered with a young growth of fir. Mr. M. W. Gorman, a member of American Forestry Association, who has spent the summer with the government's forest commissioner, sent out to make a general survey of the situation, with special reference to the reforesting by natural processes, corroborates the natural reforesting theory. In an interview with Mr. Gorman, he says in the vicinity of Sheburn the prairie and foothills were devoid of trees, the county having been burned over from time immemorial by the Indians. Since that time, say fifty years, all tracts not in cultivation have grown up with Douglas fir, seeded from a few old trees of this variety of spruce on the border of the old forest. This has not taken place in one year, but has been gradually going on ever since the annual burning has been stopped. The new growth has been available in eight years for railway ties. From a careful survey over a large district in Clackamas county we make the following notes: First acre measured gave an average of three hundred and fifty trees per acre over the district, with an average diameter of eight and one half inches, breast high; average height, about ninety-one feet; age of growth, fifty-eight years. A second acre of twenty-three years' growth made an average

of one thousand nine hundred and thirty-six trees in this district; average height, forty feet and nine inches. Another grove, seventeen years old, actually had over a thousand living trees to the acre, evidence that to this age the struggle for life had not yet begun, and they were just as first started, literally covering the ground. The next six years' growth would probably thin to one half the number, which in forty or fifty years will be further reduced to an average of three hundred to three hundred and fifty, at which they will stand for hundreds of years.

In a neglected field near Portland, cleared in 1850, and sowed to oats the two following years, and since abandoned, I have had all these years an object lesson similar to the foregoing. Today we estimate fifty cords of fir wood to the acre on this ten-acre tract. All around us tracts cleared in boom times five years ago and not yet occupied will now have to be cleared of young fir trees three to five feet high, thousands to the acre. The mountains along the Santiam river, just beyond Detroit, will convince the most skeptical on this subject;—here are vast areas of old, burnt districts, grown up to fir forest, 25 to 50 years old. Such is the prepotent virility of the seeds of the Douglas fir, carried by every breeze broadcast over the county, started into life by our first warm fall rains, and nursed into a robust and vigorous growth by a congenial soil and propitious climate.

The foregoing observations would seem to indicate that there need be no fear for the future of the Oregon forest, and all it means to the horticulturist.

I regret to say that the continuous cold rains in the blooming season of our prune, pear and apple, so interfered with my pollinating experiments that I have nothing new to offer on this subject; however, as the subject is one of much importance, and information in this line much sought, at the request of some of our growers, I am induced to give here a brief compendium, the salient matter of a former report.

The subject of pollination and cross-fertilization of fruits is now receiving a great deal of attention from the department of agriculture at Washington. This has led to some important discoveries and to the dissemination of information of great value to fruit-growers and of much interest to the student.

This is an extremely interesting field of research, and is developing some very practical and valuable lessons in commercial fruit-growing. From it we are learning the reasons for many past failures, hitherto so puzzling, and will be better

prepared in the future to avoid them. Self-pollination and cross-pollination, self-fertilization and cross-fertilizing are now subjects of scientific research, and have reached the stage of exact knowledge. In the family orchard of the olden time, with its great variety of trees, this was not a question of importance, for obvious reasons, and pollination was neither understood nor thought of; but now, with our large orchards of trees, all of one variety, this becomes a matter of vital importance, as some of us have learned in the dear school of experience. From the reports of others, experiments and from observations and experiments in my own orchard during the past few years, I present the following facts and conclusions on the subject:—

The law of sex applies to the vegetable kingdom as fully and irrevocably as to the animal, and a definite result in obtaining new varieties or improved quality is just as certain in the matter of fruit by cross-fertilization as improvement of animals by domestication. In the vegetable, as in the animal, breeding-in leads to impotency and sterility. Most of the improved varieties of fruit, especially pears and apples, are self-sterile and must be cross-pollinated with other varieties to produce fruit. Even the self-fertilizing kinds are more productive and the fruit larger when cross-pollinated. For this reason large blocks of trees of one kind should not be set, but if they are, each tree should have one or two grafts of another variety blooming at the same time, and after careful experiment and study the most prepotent fertilizer should be selected for the desired cross. All large orchards should be set with an occasional row of the desired prepotent pollinating tree.

The pears known to be self-sterile are the Buerre d'Anjou, Bartlett, Boussock, Clairgeau, Columbia, Buerre Easter, Bergamot, Howell, Lawrence, Louisia Bonne of Jersey, Mount Vernon, Pound, Sheldon, Souvenir du Congress, Wilder and Winter Nellis. A self-sterile pear may be prepotent as a fertilizer for other varieties, and generally is so. The pears that have proved self-sterile are the Duchess d'Angouleme, Bosc, Buffum, Diel, Flemish Beauty, Kieffer, Le Conte, Seckel, Tyson and White Doyenne. The effect of different kinds of pollen on the character of the fruit is sometimes very marked, and this branch of the subject must be studied further before an intelligent statement can be made. However, it is certain that even the self-fertile varieties are larger and more productive by cross-fertilization.

My attention was called to the self-sterility of the Bartlett by an isolated block of trees in my own orchard, distant from any other variety. They produced no fruit, while other Bartletts, near Clapp's Favorite or White Doyenne were breaking down with fruit. This question is of great interest in this state, owing to the solid blocks of Bartletts set out in our orchards. Unfortunately, thousands of acres are set in this way to apples and Bartlett pears in Oregon, and we have the annual evidence of weak pollination and imperfect fertilization in an unsatisfactory yield, most noticeable after a cold, wet season of blooming, when our pollen-bearing insect friends cannot work. It is now known that we have thirty or more different little insect workers, who, on a bright summer day, bring pollen from a distance and busy themselves cross-pollinating these weak-pollinating or self-sterile varieties, and to them many an orchard owes its entire crop in a favorable season and they somewhat make amends for our ignorance and mistakes in a bounteous yield of fifty-fold of luscious marketable fruit.

In the early days of orcharding in Oregon, on the theory that a different variety should be set in replacing a tree that died, I set an occasional Bartlett pear over a block of forty acres of Italian prunes; from these trees in fifteen years I never had a full crop and often scarcely any crop, which was in marked contrast to a row of fifty Bartletts of the same age on the same soil, with like cultivation, set in a mixed pear orchard near rows of the Vicar of Wakefield and Duchess d'Angouleme; these Bartletts never failed to yield a heavy crop. We had learned in the Willamette valley that the White Doyenne—called with us Fall Butter—was rich in pollen and was our best bearer, so I inserted two grafts of this variety into all my scattered Bartletts with the result that as soon as the grafts bloomed there was a full crop of Bartletts. When a tree dies in this block now a White Doyenne is set. Another striking and impressive object lesson on my grounds was a block of one thousand Coe's Golden Drop. In fifteen years these trees never gave more than a quarter crop, and after a cold and wet time of blooming, no crop. Last season the yield from these trees was not more than five pounds to the tree. All other conditions being the same, in a block of five hundred Reine Claudes, by a mistake, ten or fifteen Coe's Golden Drop had been set. These trees always gave a crop, and last year one to two hundred pounds to the tree. Had my Coe's Golden Drop and Reine Claudes been set in alter-

nate or occasional rows, it would have made one or two thousand dollars' difference on the right side of the ledger the last season in green fruit shipments and thousands of dollars in the dried product in the past ten years. I have in mind a number of commercial Bartlett pear orchards, from twenty to sixty acres, which, from personal observation, I know have never produced more than a half crop and have not proved satisfactory or remunerative to their owners, all accountable to the mistake of not setting an occasional row of the prepotent cross-fertilizing sort. The remedy yet remains to insert the proper grafts, and these orchards may yet be made remunerative. It is probable that our cold rains, which sometimes come in the blooming season, make it more necessary for us in Western Oregon to consider this subject and look to prepotent cross-fertilizers for our apples, pears, prunes and other fruits.

This whole subject has been little considered and today presents a most inviting field for pleasant and profitable research in original work, and promises a rich reward in pecuniary results as well.

Careful observation has demonstrated the fact that many of our well-known varieties of pears are wholly unable to fertilize themselves. In other werds, whenever insects are excluded and cross-fertilization prevented, most of the common varieties of pears, though they may blossom profusely, fail to set fruit.

Two distinct kinds of experiments were tried in the pollination work of the department. One of these was to tie bags of paper, cheese cloth, or fine netting over the unopen buds and outside pollination, whether brought by bees, or otherwise, excluded, thus insuring self-pollination. The other was to pollinate by hand flowers that were emasculated while yet in bud, and protect them from all other pollen by bags. These experiments have been carried on extensively. There was wide difference in the condition of the trees and in the weather at flowering time and the work was done on a large number of varieties. Under these varying conditions the results were remarkably uniform and substantially agreed.

Experiments were also tried with the apple and quince, and these showed that apples were more inclined to be sterile with their own pollen than pears. In a great majority of cases no fruit at all resulted from self-pollination, yet none of the varieties were completely self-sterile. On the other hand, the

quince proved to fruit nearly as well with its own pollen as with that of another variety.

From the experiments made, Mr. Waite, of the department, draws the following conclusions:—

1. Many of the common varieties of pears require cross-pollination, being partially or wholly incapable of setting fruit when limited to their own pollen.

2. Some varieties are capable of self-fertilization.

3. Cross-pollination is not accomplished by applying pollen from another tree of the same grafted variety, but is secured by using pollen from a tree of a distinct horticultural variety, *i. e.* which has grown from a distinct seed. Pollen from another tree of the same variety is no better than from the same tree. This failure to fruit is due to the sterility of the pollen and not the mechanical causes.

4. The impotency of the pollen is not due to any deficiency of its own, but to lack of affinity between the pollen and the ovules of the same variety.

5. The pollen of two varieties may be absolutely self-sterile and at the same time perfectly cross-fertile.

6. The state of nutrition of the trees and its general environment affects its ability to set fruit either with its own pollen or that of another tree.

7. Bees and other insects are the agents for the transportation of pollen.

8. Bad weather during flowering time has a decidedly injurious influence on fruitage by keeping away insect visitors and also by affecting the fecundation of the flowers; conversely, fine weather favors cross-pollination and the setting of fruit.

9. Pears produced by self-fertilization are very uniform in shape. They differ in crosses, not only in size and shape, but also in some cases in time of maturity and in flavor.

10. Among the crosses the differences were slight or variable, so that their variations are not to be ascribed with certainty to differences in pollen.

11. Self-fecundated pears are deficient in seeds, usually having only abortive seeds, while the crosses are well supplied with sound seeds.

12. Even with those varieties which are capable of self-fecundation, the pollen of another variety is prepotent, and unless the entrance of foreign pollen be prevented, the greater number of fruits will be affected by it, as shown by the study of Buffman pears.

13. The normal typical fruits, and in most cases the largest and finest specimens either of the self-sterile or self-fertile sorts, are crosses.

Based upon these conclusions, Mr. Waite makes the following suggestions to fruit-growers:—

1. Plant mixed orchards, or at least avoid planting solid blocks of one variety. It is not desirable to have more than three or four rows of one variety together, unless experience has shown it to be perfectly self-fertile.

2. Where large blocks of trees of one variety which blossomed well have failed to fruit for a series of years without any apparent reason, it is exceedingly probable that the failure is due to lack of cross-pollination. The remedy is to graft in other varieties and supply foreign pollen.

3. Be sure that there are sufficient bees in the neighborhood, or within two or three miles, to properly visit the blossoms. When feasible, endeavor to favor insect visits to the blossoms by selecting sheltered situations or by planting windbreaks.

J. R. CARDWELL,
President and commissioner for the state at large.

SUPPLEMENTAL REPORT OF THE PRESIDENT.

To the honorable state board of horticulture—

GENTLEMEN: As it is the purpose of this commission to publish 5,000 copies of the report of 1897 for general distribution, it seems unnecessary to more than briefly supplement that report.

Notwithstanding the failure of the legislature of 1897 to organize and appropriate the necessary fund to carry on the work of the board, private funds of the respective commissioners have supplied the urgent need in most of the fruit districts of the state, and the work of inspecting nurseries and spraying infected orchards has gone on.

Now that an appropriation has been made by the legislature, active work will be taken up as heretofore, and it is confidently hoped the whole field will be covered by each commissioner in his respective district.

The last year has shown a marked advance in orcharding, trimming, spraying, clean cultivation, etc. In the apple districts, a much larger percentage of an abundant crop of fruit

has been kept free from the ravages of the moth and fungus blights, and a large output of merchantable fruit marketed at renumerative prices, bringing to the state and the grower a very satisfactory return in gold coin. Hundreds of carloads of clean, bright apples have already been shipped to the eastern states and Europe, and much more remains to be shipped.

Southern Oregon, Eastern Oregon and Western Oregon have alike prospered, thereby much relieving the financial stringency of the times.

All over the state an abundant crop of the Italian prune has been better evaporated and better packed, and some have found a ready market; the larger sizes, 30x40 and 40x50, are now being shipped to France and Germany at speculative prices very encouraging to the trade, now bringing in these markets 10 cents to 20 cents per pound.

While it has been impossible to get accurate statistics of deciduous fresh shipments, it is fair to estimate the season's output at: Fresh fruits—apples, 500 cars; prunes, 150 cars; pears, 100 cars; plums, 75 cars; strawberries, 75 cars; evaporated prunes, 700 cars.

Prices to the grower have ruled low, yet the heavy yield has made the business reasonably profitable. Hundreds of new driers have been built, many new and experimental appliances adopted which will doubtless lead to valuable improvements, cheapening the handling and evaporation in the future. New and improved devices for dipping, spreading and packing are notable features of the season, greatly facilitating these processes. The unfortunate experience of growers in the shipment of green fruits in the long haul last season has nearly discouraged that hazardous venture; only a few cars were shipped this season from Eastern Oregon and fewer from Western Oregon. The certainty of some return from the dried product has greatly enlarged and stimulated this industry, now thought to be the only business solution of the prune problem, which, in view of the size and superior quality of the Italian prune, yet offers a fair remuneration. Forty years ago, when we figured in the prune speculation, it was confidently asserted that the area for growing superior plums and prunes free from the curculio was limited to a few districts in California, a portion of Oregon and Washington. Experience has demonstrated this a fallacy. Then our large, meaty, pitted plums, dried, sold in the eastern cities at 35 cents per pound; dried prunes, 10 cents to 20 cents per pound. Im-

ported tropical fruits were scarce and sold high. Bananas, now selling at 10 cents a dozen on the streets, then sold three for 25 cents. Pineapples were $1 each, and other imported fruits at like rates. Now shiploads of these fruits are imported into this country from the isles of the tropics and compete with our home product, and we realize that any cheap imported fruit competes with the home product, thus bringing down prices for the benefit of the people, possibly, and certainly threatening ultimate disaster and ruin to the home producer.

We have now outgrown the conceit that a limited area in Oregon and Washington must furnish all the finest Italian prunes to the world's markets. Idaho, Montana, British Columbia and favored localities along the lines of the transcontinental roads are worthy rivals in the field, and have now a monopoly of the green fruit shipments, which doubtless they will hold; and, further, it has developed that the state of New York and many other states are producers of fine plums and prunes, and to this we owe the disastrous losses in the Oregon shipments of 1897. The fact is apparent that we are too far from market to compete with the distant home products in green fruit. Certainly, with the prune, pear, cherry and small fruits, we must look to evaporating, jams, jellies and other manufactured products for our profits. This field is open to us. The fact should be recognized that while we have been setting trees and vines and cultivating small fruits, and learning orcharding, with California well in the lead, other states, Canada, British Columbia, Australia, South Africa, all the British possessions and the islands of the sea, have been likewise employed in this almost seeming world's craze. The fashion was infectious; the world is in the business, pushing it in a commercial way, with great enterprise and high expectations, each locality hoping to secure the world's market and piles of gold. The transportation facilities of modern times have fostered and encouraged this outlook. If Oregon would remain in the front rank she must lead the "push."

It is not given to any man to calculate business results in any given locality of this stupendous enterprise in fruit production. The problem is a new one and must await the evolution of time. Perhaps the fruitarian can solve the problem in the coming fruit diet for all mankind; or perhaps a trust or combine may take in the situation, stop the further setting, order the grubbing out of one half of the trees now set, pre-

vent competition and hold prices up to a paying basis. This seems to be the spirit of the times.

It is gratifying to note that again we have taken prizes in a competitive show of fruits, at Chicago, and now again at the Omaha exposition we took medals for the best display in all our leading fruits.

Referring to my last report on fertilization, experiments and observations in the orchard since that time have been confined mainly to the plum and prune. The Petite d'Agen, under paper bags and mosquito netting, have proved to be self-fertile, and strongly prepotent in fertilizing all other varieties blooming in the same season. Coe's Golden Drop and the Reine Claude bloom at the same time and yielded double the crop when fertilized with a grafted limb, or in close proximity to each other. Nearly all plums fruited heavier when grafted with other varieties blooming at the same, time. In the peach plum, Columbia, Jefferson and Washington, the improvement by thus cross-fertilizing by grafts or trees in close proximity was marked and noted by the casual observer. These experiments will be extended the next season.

Respectfully submitted,

J. R. CARDWELL,
President.

REPORT OF THE SECRETARY.

To the honorable state board of horticulture—

Gentlemen: In accordance with my duty, the following statement as to the present condition of the interest this office was created to subserve is respectfully submitted:

According to the report of the president of this board, addressed to the legislative assembly of the state in eighteen hundred and ninety-five, it was deemed that a conservative estimate of the capital invested in horticulture in Oregon was between eight millions and ten millions of dollars. "That statistics also show that the net return per acre for a series of years of orchards eight years old is one hundred dollars." Such rate of income was then only possible under the most diligent care and intelligent management. This possible rate of income, at a time when little, if any, profit could be made from the cultivation of the land to any other product, has induced great numbers of people to embark capital and labor in horticulture. Families of limited means who never before have cultivated the land; associations of people pursuing profitable business in cities, and even persons and associations resident in other and distant states, embarked capital and labor in the fruit-producing capacity of Oregon lands. Hence, intelligence in management has become the partner of capital in many Oregon orchards.

These investments were made—are yet being made—in the oldest settled districts of the state, where from thirty to forty years ago, under the stimulus of extraordinary prices for fruit during the successful gold mining period between 1849 and 1860, fruit-growing in Oregon was very profitable, but after that date rapidly ceased to be so, by reason of rapid developments of fruit productions in California.

Thus it was that for 25 years the oldest orchards in Oregon fell into such a state of neglect as to make them natural breeding grounds for all native insects and fungus enemies of fruit and fruit trees, and good covers for exotic enemies of like charac-

ter, which have been introduced from other states and countries during the past 15 years.

It is to the extraordinary development of California as a fruit-producing region that the state of Oregon has first been made a sufferer from the introduction, through interstate commerce in fruits, of destructive insect enemies like the San Jose scale, and it is largely to the determined spirit of the citizenship of that state that Oregon and other states and countries have been set the example of the use of necessary measures to cope with these parasitic enemies of sound and wholesome fruit production.

The necessity for organized effort in coping with these increasing fruit pests was the cause and justification of the institution of a state board of horticulture, by a law approved February 25, 1889.

Experience under the original law creating the board, and amendments added thereto by an act of the legislature, approved February 21, 1891, seemed to demonstrate the need of more power being given in order to efficiently protect and encourage the recently revived fruit-growing industry of Oregon. To meet such a need an amendment to the original law was passed by the legislative assembly, and approved by the governor February 23, 1895. Previous to the passage of that amendment to the law it was merely educational and advisory in its influence.

There was no power of enforcement, and no penalty for disregarding it. Consequently, it only subserved the intent of its promoters in a partial degree. The publication and discussion of the amended law, giving power of quarantine, and to clean up a foul, neglected orchard, if necessary, with the support of the county authority, which is secured by a lien upon the premises for the costs incurred, had a beneficial effect upon the general interest much beyond the slightly increased cost of the amended law. Self-respecting owners of old and foul orchards, in many cases not waiting for formal notification, either pruned and sprayed, or dug up the old, exhausted trees and planted new ones upon fresh ground. Opposition to the amended law was found to be limited to ignorant people, mainly, and rapidly diminished under a full understanding of its requirements. Failure to use the means recommended by commissioners was more often because of financial embarrassment from the depressed condition of farming as a pursuit, on farms upon which 95 per cent. of the old and neglected orchards were little considered appendages, than

from opposition to the law. From an aggregate of 6,638 acres of orchard inspected by H. E. Dosch, commissioner of the first district, during 1895 and 1896, the following is a synopsis of the results of 36 days, being part of the year's inspection work in the oldest settled portions of Multnomah, Clackamas, Washington and Yamhill counties, under the amended law of 1895. In this time the inspector visited the orchards of 187 owners of 2,423 acres. Of this, 2,177 acres are noted as "fair and good," and 246 acres, in 28 ownerships, are noted bad. The notes show, of these 28 owners, 12 as being ordered to clean up; 1 as digging up, and 2 as promising to clean up (voluntarily, it is inferred), and 9 under process of cleaning by pruning and spraying.

This is a brief statement of an examination of the condition of a portion of this district under inspection begun before the amended law had been advertised sufficiently to justify the commissioner applying it vigorously; and at a time when austere action on his part might have been made oppressive and would certainly have been very injudicious, against which the commissioners are warned by section 9 of the law.

As affording means of comparison one year later, the following results of 27 days' inspection in 1896 is here given—inspector and district being the same. In these 27 days the aggregate of acres inspected was 1,701. Of this aggregate, the acres in apples were 503; in pears, 131; in prunes, 893; in cherries, 63; in peaches, 19; of mixed or family orchards, 84; walnuts five and grapes three; total, 1,701 acres. The number of orchards inspected was 187 and the condition of these noted as "first class" and "good," 112; in fair condition, 46; in bad condition, 29. The aggregate acreage noted bad is 117, 86 acres of which were placed under orders to "clean up" and 31 acres were being sprayed or dug up by the owners. All but 6 acres of this noted bad were apples, from 30 to 40 years of age, a very small portion of which is worth the cost of attempted renovation.

It is the existence of these old and foul orchards which has created a necessity for the stringent and imperative features of the present law, the necessity for which can be seen by taking cognizance of the fact embodied in the preceding statement, showing 117 acres of old, neglected and foul orchards, averaging 4 acres each, scattered and irregularly intermixed with 1,584 acres of young orchards, averaging 10 acres each and but 6 years old from planting.

This body of orchard lands represents, in large part, the investments of men of moderate means, whose all of capital and labor is devoted to fruit-growing as a special pursuit, who have an equitable right to demand that these old, neglected orchards should, by either cleaning up or digging up, cease to be nurseries of injurious insect or fungus pests. And this is being done under the operation of the present law as fast as the nature of the requirements of the law and the condition of the community, as to means, could reasonably be expected to act.

It will be observed that of the foregoing 1,701 acres inspected, there are 893 acres of prune orchards—more than one half—and these prune orchards range from 3 to 6 years planted.

I take one sheet of the report for the double purpose of showing how these comparatively small plantations of apple orchards are intermixed with nearly 14½ times the acreage of trees from 3 to 12 years planted, and to show how capital from other states is being used in fruit production in Oregon. It also furnishes an illustration of the method now in use for recording the work of the various commissioners who are all using the same "form," a copy of each report of the work being filed in the secretary's office and forming a mailing list and history of the present condition of orchards inspected. It is as follows:—

REPORT OF HENRY E. DOSCH, COMMISSIONER OF FIRST DISTRICT.

Date.	Owner's name.	Postoffice.	Number acres.	Age of trees.	Apples.	Pears.	Prunes.	Cherries.	Peaches.	Sundries.
1896.				Years.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Sept. 8	Attending horticultural meeting at Newberg									
9	George Morrison	Dundee	12	4	1		11			
9	W. S. Allen	Dundee	17	5	10		7			
9	Fitz Lehman	Montana	7	3 to 30	1		6			
9	J. O. Pittman, in charge	Newberg								
9	O. A. Southmayd	Helena, Montana	8	5	5	5	8	1		
9	W. S. Allen, in charge	Dundee								
9	John B. Southmayd	Helena, Montana	8	3			6			
9	W. S. Allen, in charge	Dundee								
9	C. F. Jewett	Portland	275	5			275			
9	No one in charge at time of inspection									
9	W. A. Gilman	Portland	22	3 to 5	1	6	14			1
9	George Morris, in charge	Dundee								
10	R. C. Crosby	Dundee	18	3			18			
10	N. Hanson	Stein City, Montana	22	3 to 5			21			1
10	W. S. Allen, in charge	Dundee								
10	William Dyer	Helena, Montana	14	3			14			
10	W. S. Allen, in charge	Dundee								
10	Walter Ford	Galena, Illinois	10	5			10			
10	Samuel Davis, in charge	Dundee								
10	W. G. Ellis	Sioux City, Iowa	10	5			10			
10	Samuel Davis, in charge	Dundee								
10	Z. T. Davis	Dundee	41	1 to 6			41			
10	F. T. Keyes	Dundee	6	30	6					
10	Frank Stoetz	Newberg	3	35	3					
10	G. H. Greer	Dundee	3	35	3					
10	Andrew Wirt	Spokane, Washington	1	30	1					
10	M. W. Phinny, in charge	Newberg								
11	Levi Hagey	Dundee	3	30	3					
11	W. H. Gabriel	Dundee	5	30	5					
11	Mrs. P. C. Hess	Dundee	2	30	2					
11	Canby Histon	Dundee	15	6		3	2	10		
11	H. Danston	Dundee	34	5 to 30	3			26		5
11	David Smith	Forest Grove	3	35	3					
11	S. S. Banks, in charge	Lafayette								
11	Mrs. A. Greer	Lafayette	2	40	2					
11	J. S. Brooks	Lafayette								
11	Charles Bential	Lafayette								
12	George Bryan	Lafayette	3	12						3
12	J. Gaston	Portland	3	35	3					1

REPORT OF HENRY E. DOSCH, COMMISSIONER OF FIRST DISTRICT—CONTINUED.

Date.	Owner's name.	Postoffice.	Number acres.	Age of trees.	Apples.	Pears.	Prunes.	Cherries.	Peaches.	Sundries.
1896.				Years.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Sept. 12	N. J. Walker	Forest Grove	3	25						3
12	J. B. Gaston									
	Total		550	1 to 40	47·5	9·5	443	37		14

REPORT OF HENRY E. DOSCH, COMMISSIONER OF FIRST DISTRICT—CONTINUED.

Date.	Owner's name.	Condition and remarks.	Time.	Team.	Stable expenses.	Hotel expenses.	Railroad.	Postage.	Total.
1896.									
Sept. 8	Attending horticultural meeting at Newberg	One day	$ 3 00	$ 2 00	$ 0 50	$ 1 50	$	$	$ 7 00
9	George Morrison	First-class							
9	W. S. Allen	First-class							
9	Fitz Lehman	Prunes, good; apples, bad; ordered sprayed							
9	J. O. Pittman, in charge								
9	O. A. Southmayd	First-class							
9	W. S. Allen, in charge								
9	John B. Southmayd	First-class							
9	W. S. Allen, in charge								
9	C. F. Jewett	In good order							
9	No one in charge at time of inspection								
9	W. A. Gilman	First-class							
9	George Morris, in charge								
9	R. C. Crosby	First-class	3 00	2 00					5 00
10	N. Hanson	First-class							
10	W. S. Allen, in charge								
10	William Dyer	First-class							
10	W. S. Allen, in charge								
10	Walter Ford	First-class							
10	Samuel Davis, in charge								
10	W. G. Ellis	First-class							
10	Samuel Davis, in charge								
10	Z. T. Davis	First-class							
10	F. T. Keyes	Fair only, being cleaned and sprayed							
10	Frank Stoetz	Fair only, being cleaned and sprayed							
10	G. H. Greer	Fair only, being cleaned and sprayed							
10	Andrew Wirt	Fair only, being cleaned and sprayed							
10	M. W. Phinny, in charge								
10	Levi Hagey	Fair only, being cleaned and sprayed	3 00	2 00					5 00
10	W. H. Gabriel	Fair							
11	Mrs. P. C. Hess	Bad; ordered cleaned							
11	Canby Histon	Fair; cherries dying							
11	H. Danston	No care; being sold under mortgage							
11	David Smith	Bad; ordered cleaned							
11	S. S. Banks, in charge								
11	Mrs. A. Greer	Being dug up							
11	J. S. Brooks	Inspected nursery, three acres; good							
11	Charles Bential	Inspected nursery, one acre; good							
11	George Bryan	Fair	3 00	2 00	1 50	2 00			8 50
12	J. Gaston	Bad; ordered cleaned							

REPORT OF HENRY E. DOSCH, COMMISSIONER OF FIRST DISTRICT—CONCLUDED.

Date.	*Owner's name.*	*Condition and remarks.*	*Time.*	*Team.*	*Stable expenses.*	*Hotel expenses.*	*Rail-road.*	*Postage.*	*Total.*
1896. Sept. 12	N. J. Walker	Bad; ordered cleaned	$......	$......	$ 0 25	$ 0 25	$......	$......	$ 0 50
12	J. B. Gaston								
	Total		$12 00	$ 8 00	$ 2 25	$ 3 75	$......	$......	$ 26 00

"The total crop of marketable fruit in the state in 1895 was estimated at 35,000,000 pounds. It was estimated that 15,000,-000 of this was shipped in a green state, 10,000,000 pounds having been shipped east in carload lots, while 4,000,000 were shipped to local and nearby markets, including the Sound country and Montana. The remainder of the crop, some 12,000,000 pounds, was put on the market dried, weighing in that condition only some 4,000,000 pounds. The whole of the dried fruit, except a very small percentage, was shipped east." "This is the statement of the Oregonian of January 1, 1896." Its nearness as an estimate is indicated by reports of transportation companies furnished this office later, which give the aggregate of fruit exported from the state in 1895, as 19,747,740 pounds. (The carrying companies do not keep the shipments of green and dried fruits separate.) Such is a brief summary of the fruit crop of the state in 1895. That of 1896, which, for climatic reasons is the nearest a general failure ever known since fruit culture began to receive the attention of the people of Oregon in 1850. There will, however, be enough when distributed by commerce for home use and some even for export.

The quality of the fruit marketed in 1895, was a decided improvement on that of several preceding years. A moderate estimate of the fruit crop of Oregon for the year 1897, allowing for an average season, would be 50,000,000 to 60,000,000 pounds, and four fifths of the increase over that of 1896 will be prunes, which by evaporating can be sent to the most distant markets.

The causes which, to a large extent destroyed the fruit crop of Western Oregon for the first time since fruit culture began here, had also the effect of destroying vast numbers of insect enemies to fruit and fruit trees, the increase of which is encouraged by our usual mild winters. That cause, combined with greatly increased and more intelligent use of spraying, has left the tree growth of the past season in a more than ordinary condition of health and vigor. While the extraordinary cold and wet spring months prevented the blossoms of trees from fructifying, and destroyed myriads of incipient insects, the same general cause was unfavorable to the health of trees standing on ill-drained lands. It was also favorable to the increase and spread of many kinds of fungi and bacilli. It has heretofore been a general belief among intelligent horticulturists that each species of fruit trees has its special parasitic enemy in both insect and plant life, but how extensive

this variety is, and what is the special function of each, has not yet been told by the scientific man to the man of practice definitely, relative to many of both classes.

Many practical fruit-growers yet ascribe to excessive heat or cold injuries to vegetable life which scientists ascribe to other causes not yet defined. The commissioners have heretofore inspected in the belief deduced from palpable differences of outward manifestation upon diseased trees that each diverse species of fruit is affected with disorders peculiar to itself. That each species has diverse parasitic enemies, both animal and vegetable, from the tent-worm and codlin moth in the one case, down to the minute pear-leaf mites; and from coarse mosses and lichens, down to fungi and bacilli, only to be identified by the finest glasses in the hands of patient, painstaking experts. There is now a great number of educated men constantly at work trying to identify and classify these enemies to practical horticulture, and in devising the simplest means by which the cultivators can keep in subjection these enemies.

Some of the foremost schools in the oldest states (like Cornell university), recognize the importance of this branch of knowledge and accept the charge of experiment stations provided by law as a means of disseminating information to practical men, which only scientific men with the best instrumentalities can with certainty dispense.

It was stated by the secretary of this board in his report of 1895, that by "efforts of the board, Max Pracht, and others, Prof. N. B. Pierce, special investigator for the United States department of agriculture, had been induced to visit Oregon for the purpose of securing his aid in defining various fungus diseases affecting fruits and fruit trees here." The nature of these diseases was not well understood when Professor Pierce visited this state. Mention is made by the secretary of one question settled (we are to infer) by Professor Pierce while here, namely, the pear-leaf blister was discovered to be the work of a mite (*Phytoptus pyri*) and not a fungus disease as has been supposed. There was arising at the time Professor Pierce was here a question of the number and nature of fungus diseases among fruit trees of the entire Pacific slope, but most observed in Western Oregon and Washington, which is not yet settled. The amended law had not been published the time required by its term, in April, 1895, until a case arose which seemed to demand its enforcement with the utmost stringency. A nursery of prue trees at Canby in Western

Oregon was traded by its proprietor for real estate to a citizen of Portland, who sold a portion of the trees for other real estate to parties in Eastern Oregon, and the latter began shipping and selling in differemt sections of that portion of the state. One large lot was stopped in Umatilla county and destroyed not only with the consent, but with the advice of the shipper. The following is a copy of the shipper's letter on file in this office:—

——, April 26,——.

C. A. Hobbs, Freewater—

DEAR SIR: I have just been called to examine a specimen sent from the sales, shipped by me to Messrs. Cox and Ford, by you to George I. Sargent. I find they are badly diseased, and while I disclaim ownership, I think they ought to be destroyed at once.

Yours truly,

E. S. McCOMAS.

In Union county a large shipment had in part been distributed by sales, most of which was destroyed at the request of the commissioner of the district. The business of shipping was arrested by public attention being attracted through the press. This nursery was inspected again and again, and on a third inspection not more than thirty per cent. of the trees in the nursery rows were found free from perceptible disease; and after a fourth inspection, a certificate was refused. This case seems to give reason for the opinion that this disease was made general, or nearly so, by the use of scions taken from diseased trees—of course, unknowingly by the nurserymen. It must be admitted that the assumption of this being a fungoid disease, increased by grafting scions taken from diseased trees, demands unquestionable scientific proof (here it is only submitted as a surmise).

The bodies and branches of some of the trees condemned by Commissioner Hobbs were sent to Prof. Newton B. Pierce at Santa Ana, Cal., whose statement in relation to them was: "The twigs are now dry, and hard to examine with any hope of learning the cause of the trouble affecting them; I find, however, that there is a fungus quite commonly present upon them. What this fungus is and whether the cause of the blistered appearance of the twigs, or not, I cannot safely say without further and continued study. However, in case it is a fungus, I could only recommend that the nursery stock be carefully sprayed with the Bordeaux mixture while dormant,

and in case the trouble develops in the summer to give them a like summer treatment."

In this same letter dated June 8, 1895, Professor Pierce tells this office he has succeeded in extensive experiments in Sacramento valley in preventing the peach leaf curl, and has also "successfully grafted deadspot" or "apple canker" by innoculation into the bark of a healthy tree the fungus taken from diseased bark from Olympia, Wash.

In a letter to J. M. Wallace, president of Salem Waterworks Company of Salem and manager of the extensive Wallace pear orchard near the city, under the date of April 30, 1896, Professor Pierce says: "My work in Oregon, and later at this laboratory, has demonstrated one thing beyond a reasonable doubt, namely, that the apple canker so common in Oregon, is a disease due to the action of a parasitic fungus. Innoculation experiments here have reproduced the disease in a typical form in perfectly healthy apple trees. So far, so good; but it is not so sure to me as yet that the trouble with the pear is of exactly the same nature, though it is still highly probable that such is the case. My work having been done mostly with the apple is the reason for greater certainty in that case. I have in that case found the various spore forms, as well as the tree which probably forms the native host of the parasite in in Oregon and Washington. It has also become evident that the fungus works mostly during the rainy season, and that infection of new trees may take place in the fall and during most, if not quite, all winter. This shows that **trees must be** treated before the rains begin and often during the winter to prevent infection of new unaffected parts. Now, the question arises, is the pear disease the same or similar? This I cannot decide without further study."

The foregoing information from Prof. Newton B. Pierce, is the latest, or up to date, information yet received in this office as to one form of tree disease, known to orchardists of Oregon and Washington as "deadspot" or "apple canker." It will be noted that Professor Pierce is not, at the time of his writing, sure of there being any kinship between "apple canker" and the "pear blight," in which Mr. Wallace is much interested and to which his letter relates. To the diseased prune trees sent him from the lot to which Mr. McComas's letter relates, (and samples of which were repeatedly sent from the nursery rows subsequently), there is no more allusion. Professor Pierce is unquestionably right in his view that the mild, open winters of Oregon are very favorable to the production and

spread of fungi of unnumbered kinds. What the practical fruit-grower desires to know is, are these found on the apple affected with deadspot or canker, feeders on the living tissues of the tree, as the mistletoe lives on the noble oak, and as the fungus we call rust feeds from the surface of the seed stem on the sap, the blood, of the noblest bread plant—wheat—blighting the farmers' prospects for harvest, or, is it one of the fungi which fastens on trees already stricken with disease? Professor Pierce writes as if fully satisfied that the fungus is the cause of canker, and his recommendation of the liberal use of double strength Bordeaux mixture of ten pounds of copper sulphate and ten pounds of lime to forty-five gallons of water as a spray, after the leaves fall, indicates belief that the spores of the fungus are near enough the surface of the bark to be destroyed by the spray. This being so, it is easily supposable that these spores may be on young wood used as scions for grafting, and so increasable by that process, or even by late budding.

As to the pear blight and its supposed cause, the preponderance of opinion under present conditions of knowledge is that it is the work of bacteria, a still lower and more minute agency than fungi. It is even claimed by some students of the subject that bacilli is sometimes found in the sap of a pear tree injured by blight, after all the apparent injury has been removed and the sap appears in a normal and healthy condition. This suggests the question, are these bacilli present as an agency of destruction, circulating in the sap of the pear tree, ready to germinate and grow as an agency of destruction, when by any means, or from any cause, disease attacks the tree, as we have reason to believe the spores of the fungi we call smut enters into the sap of the wheat plant and fills with its repulsive poison the hull, healthy nature fills with a sound germ and life-sustaining flour?

The farmer, who is in Oregon generally the fruit-grower also, has long ago learned the potency of both the lime and the sulphate of copper (blue vitriol) in killing the spores of the smut fungus, which, when present, attaches to the minute down on the end of the wheat kernel to be ready to enter into the new birth of a new plant; and, soaking his seed grain in a solution of bluestone, is one of his cares, as a clean farmer, he will not omit; but, as he knows there is one kind of fungi—the rust on his too-rankly growing grain, he is yet unable to contend against, thus showing him two species of fungi that can blight his hopes of a grain harvest; it is easy for him to

believe his fruit trees may each, according to its kind, have two or more parasites as minute and diverse; and the manifest difference between the apple canker, the pear blight and gummosis of the prune and other stone fruits causes the majority of close observers among practical orchardists to believe there are at least three, and probably many more.

The nursery at Canby contained such a large proportion of trees having what Professor Pierce called a "blistered" appearance as to cause the writer, who inspected it in July, 1895, to believe in some nearly general cause, and Professor Pierce's success in grafting "deadspot" points in that direction. This case, it must be understood, arose out of the action of the commissioner of this board and proved the primary cause of the Oregon nurseryman's association co-operating with it at its October meeting of 1895 in the formation of rules for the inspection of nursery stock prior to shipment. Rules were formed and a certain rate of fees for inspection was agreed upon, but upon a doubt of the legality of the board charging a fee arising, the practice was suspended and the advice of Attorney-General Idleman solicited upon that and other points, and his opinion was adverse to charging fees. The rules of the railroad companies of the state proved of very great service to the board in the introduction of its rules relative to shipment of nursery stock and their effect on the general condition of Oregon-grown nursery stock shipped was such, that at its meeting on the ninth of May, 1896, the state board of horticulture of Washington passed the following resolution and sent this office through its secretary, Mr. C. A. Tonneson:—

TACOMA, WASHINGTON, May 9, 1896.

John Minto, secretary board of horticulture, Salem, Oregon—

DEAR SIR: At our last meeting our board passed the following resolution: *Resolved*, That we as members and inspectors of the Washington state board of horticulture, both as a body and as individuals, accept the inspection of the authorized officers of the Oregon board of horticulture of nursery stock from such nurseries in Oregon as have taken out a license to sell in this state, when copies of inspectors' certificate accompany the shipments of trees; *provided, also*, that this board hereby request that members of the Oregon board honor the authorized inspection of this board without further expense to shippers in a similar manner.

C. A. TONNESON,
Secretary.

This board, at its October meeting of 1896, by formal resolution, thanked the state board of Washington for its implied compliment on the character of Oregon nursery stock, and assented to the terms of its resolution.

Oregon-grown nursery stock seems to have fared well, also, under the careful inspection of California, as her horticultural reports in this office shows no instance of Oregon-grown imports into that state being condemned or delayed. Only one case (except that from the Canby nursery) has arisen under the amended law, of a shipment of nursery stock not clean, which was formally brought to the notice of this office, and that was immediately ordered returned to shipper at his expense, upon notification. Another case, informally brought to the notice of the secretary, was the reception by one nursery firm from another of 150 prune trees of a certain kind, out of which an expert judge threw 16 trees, which probably had been put in by an ignorant employee and would likely have been taken by an average buyer.

The need of more definite information from scientific experts was informally discussed by this board at its October meeting in 1895 and Commissioner George A. Hobbs, upon the adjournment of the board, spent a few days conferring with the gentlemen in charge of the experiment station at Corvallis, shortly after which President Bloss of the agricultural college and director of the station, in company with Profs. U. P. Hedrick and A. B. Cordley, visited this office and made verbal proposal of co-operation between the board of horticulture and the experiment station. This being highly desirable for public reasons, communications between the scientists of the station and members of the board have been kept up since. It was in view of this proposition of co-operation that at the suggestion of Commissioner Dailey, samples of pear branches from blighted pear trees in the orchard of the state insane asylum were sent to Professor Hedrick in August last, asking him if he could define the cause of the disease.

In a letter dated August 20, he says: "Samples of pear branches at hand. I am perfectly familiar with the disease. It is the so-called canker, caused, as Professor Pierce thinks, by fungus similar or identical with the one causing canker on the apple. Professor Woodward, of California, calls it crater blight of the pear and ascribes it to the work of a minute bacteria."

There were some of the diseased branches that showed the

peculiar cracks Professor Woodward mentions as distinguishing "crater blight" and some showed no break in the outer bark. The trees were many of them blighted so that the entire top was dead to the body of the tree. But both myself and Mr. Dailey concluded lack of drainage in conjunction with the extraordinary season was the cause of the loss, though it is very possible that the dying and dead branches may show as effects fungus growth on some of them and bacteria growth on others. It will be noted in this connection that Professor Hedrick seems to take Professor Pierce's opinion that the pear blight is probably caused by a fungus, and is not of bacterial origin as Professor Woodward, of California, has published, finding proofs of to near the same extent of Professor Pierce's experiments with fungus in connection with "apple canker." Whether fungus in the former's experiment and bacteria in the later's were effects or causes is not settled. These differences of observation by two students do not preclude the possibility that both are right and that both fungus growth and bacterial growth are sometimes present on pear trees as an effect, not as a cause, of death or disease. Looking at the dead and dying trees in the state insane asylum orchard and others near it, and seeing those trees dying altogether most frequently, and the lowest portions of the ill-drained plot, noticing the same fact in the nearby orchards, I concluded the cause was—the trees died from being in unhealthy conditions for tree life. That a line of Professor Hedrick's letter to "make sure that the orchard is thoroughly drained" was sound practical advice, freely given the officers in charge of the orchard, leaving the question of cause in an unsettled and very unsatisfactory condition, in which state of mind I wrote to Hon. H. B. Miller, president of the agricultural college and director of the Oregon experiment station, giving a brief outline of the foregoing facts and asking if, with the instrumentalities of the station, an effort to solve these questions for ourselves cannot be made? He kindly acknowledged to having met the same difficulties I outlined and will be glad to put the station in the way of solving them if possible. In such efforts the entire membership of the board of horticulture will co-operate in every practical way to aid the gentlemen in charge of the Oregon and United States experiment station to solve by scientific demonstration the so many questions yet unsolved as to make the study and practice of horticulture an attractive field of labor to educated minds.

But it must be noted that the force at the state agricultural college and experiment station have at present alloted fields of labor which, if performed, will fully occupy them. This work needs a specialist, having no other duties than such as Prof. Newton B. Pierce was sent to California by the United States department of agriculture to do. The immense field of California fruit-growing interests and those of Arizona, having a dry, warm climate and the use of irrigation, insure abundance of employment for Professor Pierce south of the northern line of California for many years to come. The fruit interest of Oregon and Washington, under similar conditions but differing from those of California, points to the necessity for a specialist to investigate for the north Pacific as Professor Pierce is doing where he is. Our senators and representatives in congress ought to be furnished with petitions to this end. Meantime, the commissioners are at work, either by personal instruction and advice while on inspection tours, or by letters written from their homes, the particular result from which is indicated in their respective reports and the general results of which are indicated by the facts that at both the state fair last held at Salem and the more extensive exhibits at the Portland exposition were the cleanest and most extensive exhibits had for the past fifteen years. In addition to the foregoing facts is another, that Oregon has not been, is not yet, fully known in her capacity for fruit production. At the Portland exposition the most extensive and fairest displays were from counties east of the Cascade range, the counties of Union, east, and Umatilla west of the Blue mountains, making grand showings, both as to varieties and condition, while far off Wallowa and nearer Wasco had collections that would have been highly creditable to any district of our wide country. Not of the least importance to the horticultural interests of the state is the fact that fruits from the interior to the great Cascade mountains will this year meet a want in the western part of the state, caused, for the first time in our history, by an untoward season.

There are in this office the names of over 3,000 orchard owners, and to meet the wants of them and others for up-to-date information in regard to orchard management, a bulletin of nearly 70 pages has been published and distributed at the cost of the board's fund, to meet a want the edition of the biennial report of 1895 was not printed in sufficient numbers to supply. Five thousand of these bulletins were printed and over 4,000 copies have been distributed, containing informa-

tion relative to the pollination of fruits; the importance of thorough drainage and simple rules for ascertaining when land is by nature sufficiently dry for an orchard site; directions as to planting, pruning and spraying; time to spray; the formula for composing sprays and when to refrain from their use.

The exact number of orchards in the state cannot be given by the commissioners under the present law. A state census only, could furnish that information. Taking large and small into the account, an estimate of 90 per cent. of the number of landowners would be a close approximation.

THE FORESTRY INTERESTS OF OREGON.

Since the issuance of the third biennial report of this board, the care of forests has been brought to the attention of the people of Oregon in a way that has arrested public attention.

The United States government has withdrawn from sale or occupancy, under the general land laws, over 4,500,000 acres of the Cascade range of mountains as a "forest reserve," an area nearly as large as the three original states of Connecticut, Delaware and Rhode Island combined. This reserve is so laid as to create a physical division of the state from the Columbia river, the northern boundary, to within 24 miles of the California line. A commission of 12 members of the national academy of science, at the request of the secretary of the interior, visited Oregon during the summer of 1896 as an advisory body to that department (it is understood) as to the course to be pursued in the management of that reserve. The visit of this commission is an indication that it may mean the adoption of a national policy of bureau or commission government from Washington City, independent of, and it may be feared often in contravention of the right of the state to control in the matter of local interests, together with action of officers of the district court of the United States in arresting and prosecution of sheep and cattle owners for trespass, has created a feeling of unrest and dissatisfaction at what seems an unjust and uncalled for invasion of the rights of citizens of the United States in Oregon to acquire and use the land and its natural wealth as fully and freely as the citizenship of any other state. This seeming threat against the dominion of the state over local interests, and suspension of the general land laws against landless citizens in what may be said to be the heart of the state, occurs at a time when the industries of the people of Oregon are beginning to turn

toward her timber wealth as never before. The exhibits of woods at the state fair at Salem in 1896, and those at the industrial exposition of Portland at the same time, were the best ever made in Oregon,—epecially the latter,—thus proving and directing interest in our forest wealth. There is no question between reflecting citizens of Oregon and the body of scientists alluded to who have visited the state, as to the importance of the forest wealth within its lines. Residents here, with a better knowledge of our climate, may differ widely from them as to the necessity for action at this or any time, by the government of the United States taking the care of the forest growth in Oregon upon itself. The initiative taken in Oregon for this reserve in 1889 asked that it be given to the state to care for.

The report of the president of this board is respectfully commended to the attention of interested readers upon the subject of natural reforestation which has taken place in Western Oregon under natural processes, since the grazing of domestic stock prevented the running of dry grass fires, which, under methods of the native race, not only consumed the young seedlings encroaching upon the open lands, but extended the latter by frequently entering the mature timber belts. Having a longer residence in Oregon than President Cardwell, and being intimately connected with grazing pursuits (sheep especially), since 1849, the writer can fully indorse his view—that it is unnecessary at present for the general government to invade the right of the state of Oregon to local control of her local interests. From 25 years' contention against young fir and oak spreading over a close grazed sheep farm, and from another 25 years of close observation of the way the Douglas fir and pines spread on pastured openings of summit of the Cascade range,—the writer is decidedly of the opinion that national care of that is not necessary, and that it is highly probable will never be necessary, as the people of Oregon know what it is costing the state of New York, being late in attention to her interests in forestry; and they also are aware of the injury claimed to have resulted from too much deforestation of the upper Ohio valley. The arrival of this forestry commission will, however, result in good to the people of Oregon. It will cause some owners of land upon which young timber growth is now set, to care for it rather than destroy it, by the use of the axe and firebrand, as has been done so much in the past. It will cause others

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to hesitate before cutting off a young oak growth and putting goats in to exterminate what may in a few years grow to more value for manufacturers' use than any other crop the land would produce.

The development of settlements on the Pacific slope has reached a point which constrains the landowner towards intensified care in the selection and cultivation of his field crops and his orchards. It should also constrain him to like care for his lots of native timber, his fir, oak, ash, maple and water poplar (balm); and should induce him to question whether it is not worth something to his holding to plant his watercourses and waste corners with other kinds of wood used in the arts,—as white ash, elm, beach, white poplar, black walnut, black locust, pecan, hickory and basswood. Street trees in the cities of Portland and Salem, planted in memory of the childhood's home of the planter, show growths of 22 to 34 inches in diameter of bole, 3 feet above the ground; of locust, walnut and other species, the growth of from 30 to 40 years. Such trees now surround the homesteads of very many Oregon farmers who began life here on unshaded open lands, and the practice of such plantings is spreading over the hot open lands of Eastern Oregon.

The location of the "Cascade forest reserve," in so far as the needs of the people of Oregon are concerned, is 100 miles too far west. It would have been a great help to the settlers on the treeless plains of Sherman, Gilliam, Morrow, Umatilla and other counties of Eastern Oregon, if for the past 25 years they could have been permitted to purchase timber on the mountains in 5 and 10-acre lots. To adopt such a policy yet would render unnecessary the use of methods in securing fuel and fencing material upon these treeless wheat lands, which tend towards degradation of good citizenship. The past and present condition of homes in the eastern half of Oregon in relation to a present need of a timber supply, honorably obtained, gives such settlers a keen interest in the conclusions of this forestry commission, as advisers in what may be seriously against, rather than favorable to, a more cheaply obtained supply. Such settlers, living on treeless lands 50 to 70 miles from the nearest timber, are justified in asking of these learned men careful consideration of a question which may not affect them personally, but is of great moment to their fellow citizens of Oregon.

It is understood from the reported statement of Professor Brewer (a member of the commission) that "it was appointed

by the secretary of the interior at the suggestion of the National academy of science, to thoroughly examine into and study the forest question, and recommend a future forest policy before the next congress." The largest of the forest reserves, as yet proclaimed, being in Oregon, makes the action of the commission and its recommendations subjects of grave consideration for legislators of the state as well as for the state's representatives in congress. This board being the nearest to forestry as a state interest of any state agency, should need no apology for thus calling public attention to this important subject. The indications given out by members of this commission and by John Muir, the pioneer explorer of and writer on the subject of the higher mountains, forests and glaciers of the Pacific slope, give indications of the commission favoring the policy of national control and management of forests.

B. E. Fernow, chief of the division of forestry of the department of agriculture, and probably the foremost writer on this subject in the United States, says of governmental management in Europe, that "In Germany less than one third of the forests' area is managed by the government, and 19 per cent. is owned by communities and corporate institutions. In Austria not more than 13 per cent. is under government administration; in Italy less than 2 per cent. In France 10 per cent., and 27 per cent. owned by communities under government control. Spain owns 4½ per cent. of the forest, but controls 80 per cent. owned by communities. In the Scandinavian forests, 15 to 20 per cent. are owned and managed by government. There is hardly any more forestry practiced than in Maine, where some owners restrict the cutting of trees to certain sizes. The same may be said of Russia, the crown owning about two thirds of the forest, and has just begun some management, private owners standing about on a level with the American timber landowners. England has practically no forests of extent, only 3 to 6 per cent. covered by plantations (of landowners). Its equable climate and configuration have not made this deficiency felt, but public interest has lately been directed to the profitableness of forest growing on waste places, and more attention is being paid to sylvia culture."

Such is Mr. Fernow's statement respecting the status of European governments in regard to forest management, with the exception of Switzerland, "where, since 1874, the federal government, while owning but little over 4 per cent. of the

forest area, exercises supervision over 66 per cent. of communal forests. Private forests, when not classed as protective, are only prohibited from being cleared."

We may see by scrutinizing this brief statement, the tendencies of these old governments in regard to their interest, from the most feudal to the most free, the most autocratic and the most democratic. We see England, the most free, leaving this subject to the common sense, good taste and business judgment of her people at home, while with her subject, India, the government has established a full forest administration, which nets annually several million dollars. The question then for the people of Oregon to decide (allowing that when the question is raised before the next congress her right to dominion within her boundaries will be considered) is which of these old world methods is most in accord with the spirit of the American people and the genius of their governmental system? It is a very serious question, not only for the people of Oregon, but for the citizenship of the whole United States. The climate of Western Oregon is superior even to England's in its fosest producing power, and the streets of every city and town bear witness to the fact that her people are lovers of trees around their homes. That is a race tendency which shows itself all over the United States where a home can be made and trees induced to grow. So general is it that the present secretary of agriculture owes his present responsible position over this very interest more perhaps to his taste for trees and personal energy in planting them around his home than to any other generally known trait or tendency, his example in this respect bidding fair to become a national inheritance, stimulating the planting of trees and by recognition of Arbor day all over our wide land.

Conceding that national attention and national expenditure is justifiable, because necessary, in some districts of the United States, it is respectfully submitted that instead of the intervention of the national government to prevent the distribution of the forest wealth of Oregon, through commercial lines, to regions without forests, where lumber for home building is a first necessity, the treeless plains of Western Kansas, Nebraska, Wyoming and the Dakotas should receive the first attention of government in this respect. And instead of putting 4,000 men under pay of the United States to guard the ripe forest growths of Oregon from use by her citizens, would it not be better to double the number of men and money required and institute a systematic effort to produce a forest

growth by the aid of irrigation on chosen bodies of public lands of those states so much in need of trees?

Mr. Fernow in his excellent treatise (bulletin 5, United States department of agriculture, forestry division) gives 5,000 officers, clerks, foresters and guards used in the management of the 6,000,000 acres of forest by the kingdom of Prussia, which is perhaps the most complete representative of a modified feudal form of government now in existence. The net revenue resulting from the care of this body of selected and trained men is 96 cents per acre annually. This, it must be noted, is the result in a country where forest products are of greater importance to the people than they are in any portion of our country except the treeless districts of the states I have mentioned. From the same table by which Mr. Fernow gives the foregoing results we learn the fact that the most democratic community named — the city of Zurich in Switzerland — shows a net revenue of $4.40 per acre annual revenue from its 2,700 acres of forest.

In conclusion, these brief extracts are given as indications of the best that can be expected from the proposition to protect the native forests of Oregon from the use of the people. It is heartily conceded that abuse of liberty to attain ownership and use should be promptly and severely punished. But with the aid of stringent laws, properly executed, the forest wealth of Oregon may safely be left to her people, who, having as fair a measure of common sense as their English cousins, may be trusted to manage their resources as well.

JOHN MINTO,
Secretary.

SUPPLEMENTAL REPORT OF THE SECRETARY.

The failure of the legislative assembly to organize in 1897 left only the 1,000 copies of the biennial report covering the years 1895 and 1896, which the law provides for the publishing of without special act of the legislature. This number had proved entirely insufficient for the foregoing two years, and the board had been compelled to publish bulletin nine (9) as the best practical means of meeting the rapidly increasing demand for instruction. Much the larger portion of 1,000 copies are now required to supply members of the legislature, the press of the state, experiment stations, high schools and horticultural bodies of the United States and foreign coun-

tries, so that before the ineffectual efforts of the legislature to organize proved that no needed addition to the number published could be hoped for by its authority, there were but a few hundred copies left in the control of the secretary of the board, and the commissioner of the fourth district alone made application for more than were undistributed.

The failure of the legislature to organize had also the effect of stopping the field work of commissioners to a serious extent, as the failure of an appropriation to meet the expenses of the board created a doubt in the mind of the secretary of state as to his duty to audit the accounts of members for time spent and expenses paid out in field work. Claims for service and expense were received and filed, to be audited and paid after an appropriation should be made. This is not stated as complaint, but in explanation of the fact that the lack of the necessary appropriation has impeded the field work of commissioners, and the lack of publications by which instructions could be most effectively given, in default of personal visitations of orchards, have injuriously militated against the work of the board.

Yet progress has been made. The value of the fruit interests of the state has been greatly increased in 1898 over any previous year. The quality as well as the quantity of the fruit exported was a decided improvement over the quality for many previous years, particularly so with reference to apples exported; and to apples as an export fruit, both green and evaporated, the prune and the pear may be added as the most important fruit products that the climate and soils of Oregon will continue to produce in increasing quantities for many years to come, of quality which need fear no competition in the markets of the world, if intelligence and care be employed.

For the first time in many years past the shelf room at the state fair at Salem was occupied by private exhibitors, with mainly unblemished specimens. The same is true in regard to the fruit exhibits made at the Portland exposition, which is annually becoming a more complete exhibit of the industries of the state at large, than is the state or district fairs. The exhibit there of fruits grown in Eastern Oregon were markedly cleaner and finer looking than those from the older settled counties of Western Oregon, owing, doubtless, to the fact that they were the product of younger trees, in part to the freedom from insect pests, but in still larger part from the climatic influences that prevent the growth of fungi. The

apples shown from the Grande Ronde and Eagle valleys, Wasco and Wallowa counties, were especially notable as being equal to those of Western Oregon when fruit growing there was a young industry; and the fact that these fine fruits come from districts within or near the pine belts, of considerable elevation, is a natural indication that the fruit-producing capacity of our soils and climate is commensurate with the boundaries of the state; that in addition to the wonderful results in production that can be had from the canyon bottom lands and open plains under irrigation, orchard fruits can and will be grown at least as high up as the yellow pine and the yellow fir (Douglas spruce) grows on our mountains, when the exigency of population shall require the planting of orchards on these higher lands.

It is quite likely that for some years to come fruit orchards will be planted and give most certain results on the irrigated lands of the eastern portion of the state. But ultimately economy will use irrigation water in productions more necessary than in fruits beyond the requirements of the home; and such crops as alfalfa hay will secure the use of water for irrigation as next in importance to human and livestock needs for water, as the fact is rapidly meeting with general recognition that the alfalfa plant is becoming to arid and sub-arid regions of our country what the corn plant is to all the country east of the west lines of Kansas and Nebraska.

Nature furnishes a lesson to horticulturists in planting her fruits that are congeners of orchard fruits along natural water courses where they have sub-irrigation, or on the natural slopes west of the Cascade range which decline from the intensity of the sun's rays, and least subject to the bleaching influence of the southwesterly winds and rains that prevail in the winter season. The crabapple, hawthorn, service berry, wild cherry, wild plum or wild grape are rarely found far from the courses of living waters, and when they are, it is on lands sloping northward or westward,—slopes on which the deepest and strongest soils are found in Western Oregon,—slopes with a strong tendency to being clothed with timber or brushwood, where those facing east, south and southwest are grass-covered only.

This is the general law of natural fruit production west of the Rocky mountains from which I deduct the following as the fruit-producing capacity of the portion of it covered by the bounds of Oregon:—

1. Fruit culture can be made successful up the courses of

streams (given a sufficient depth of soil) from the level of the ocean tides to near upper edge of timber growth on our highest mountains.

2. Wherever the conditions of soil and climate permit the natural growth of the yellow fir or Douglas spruce, there will our most important export fruits of apples, pears and prunes grow with least labor, and with least loss from diseases caused by the sun or unseasonable influences.

The census of 1890 divides the surface covering of Oregon into forest acres, 20,600,000; woodland acres, 17,000,000; treeless acres, 19,402,400; improved acres, 3,516,000.

From this it will be seen that if my position accords with natural laws and man's power to aid, Oregon's population as yet has just begun to touch her fruit-bearing resources. Close observers are beginning to see that much of the labor and care that has been applied has been lost, largely through mistakes in choosing location.

So far as experience yet indicates, the localities most favorable to particular kinds of fruits, the apple succeeds so far in every portion of the state; peaches have been heretofore most cultivated in the treeless portion of the Rogue river valley, particularly near the timber line at its head around Ashland, Jackson county. Medford, a short distance westerly, is the shipping point for some of the most extensive and best managed apple and pear orchards in the state, but there is every reason to believe the entire valley is favorable for the production of the fruits mentioned, to which may be added grapes on its southern slopes, and prunes on its lower levels where the wild plums once grew.

The valley of Umpqua, which was the northern limit of the wild plum and grape, is proving to be one of the most favorable portions of the state for prune orchards. Coming north into the Willamette valley we come to the congenial home of the apple, pear and prune, also of good peaches and grapes in the warmest, most sheltered localities, or the latter on the south slopes of highlands, to an extent yet little understood or appreciated.

The statistics of the fruit production of Eagle valley, near the northeastern corner of the state, are very interesting as indicative of future possibilities of production in the thousand or more upland valleys, the heads of streams, yet to be occupied by the very best of a nation's resources — brave men and fair women, nurtured by the abundance and strenghtened by the industries required to secure the comfort and independ-

ence that makes life agreeable and pleasant "far from the madding crowd."

The commissioner's statement shows approximately 400,000 pounds, aggregate production, of the six kinds of fruits, apples, pears, apricots, plums, prunes and peaches, with 100,000 quarts of blackberries and 120,000 pounds of honey added,—and the main crop yielding the last sweet item is barely named, the alfalfa meadows, the basis and insurance of the stock-growing industry of the highland pastures, surrounding this valley of 7 by 3 miles in extent, 3,000 feet above sea level. It looks and it is a fine showing, but that it is far below the possibilities of the 42 half section farms within the measurements given, I add, for comparison, the shipments of this same season from the Wallace fruit farm near Salem: 14 carloads of green fruit, 340,000 pounds of which (2,800 boxes) were choice winter apples, sold at $1.00 per box, C. O. D.; the balance Bartlett pears, sold in Chicago and New York. These 14 carloads of pears and 2,800 boxes of apples were not secured by indolent waiting and hoping for immunity from the attacks of fungoid or insect pests, but by the thorough use of means of prevention. Last year a block of the apple trees was bearing so sparingly that it was deemed not worth while to spray them. The fruit when gathered filled 400 boxes, out of which only 30 boxes were free from the blemish of the codlin moth. This year, by the use of four sprayings, all but about 5 per cent. were unblemished. The last spraying was done in September.

The thorough use of efficient sprays is deemed one of the most essential means of producing perfect fruit in that orchard, and the appearance of the pests is not waited for.

This fruit farm of 323 acres, of which less than 200 acres are yet under fruit trees, was begun 12 years ago by the late R. S. Wallace, and has been planted through a series of six years to 12,000 pear, 3,200 apple and 2,000 cherry trees, leaving still 123 acres of grain, meadow and timber. Were it deemed best to use all its resources in the production of green, cured and canned fruits, the output could be doubled, if not trebled, within a few years. And this is a typical sample of 3,000,000 acres within the Willamette valley, which, in itself, is but about one third of the area of Western Oregon, upon which the earlier and later rains fall with a regular certainty, which insures its inhabitants immunity from a water tax for purposes of irrigation; and though the seasons vary, wet or dry, as compared with each other, seedtime and harvest has

not failed since the first quart of wheat was sown in 1828. Too much water in the soil is a more common injury to orchards than too little.

This certainty of the seasons, the general conditions of soil, as well as climate, the general diffusion of timber for fuel, the transportation facilities, insure the steady increase of fruit production in Western Oregon and its permanent continuance in competition with districts of this state and neighboring states where fruit-growing is now an inviting and profitable pursuit, will fail under the cost of irrigation processes.

IN REGARD TO STATISTICS.

Various efforts have been made by my predecessors to collect the number of acres and quantity and kinds of fruit produced in the orchards of this state. These efforts have been abortive so far. The reason of this is the manifest impossibility for any member of any one of the districts to get over it in one season. The more imperative work of instruction and inspection claims his attention. Either the enumeration of fruit trees must be one of the duties of those taking the state census, or an additional officer provided for by an amendment to the present law. There is not, nor has there ever been, a complete and accurate list of the orchards in Oregon. There is not, nor has there ever been, a definite and accurate statement of the quantity and kinds of fruit exported from Oregon. The transportation companies doing business here have rendered good service in aid of the enforcement of the law creating the board. They have given the amounts of shipments of fruit in carload lots, but they themselves have not regularly separated the cured fruit from the green fruit shipments. In regard to values of such shipments, the difference should be fully threefold in favor of cured prunes as compared with green.

The competition for business between transportation companies renders the management of them very careful relative to giving out for publication, so that an estimate is all that has been obtainable in relation to any particular line until weeks, sometimes months, beyond the close of the calendar year. The estimates of the total marketable fruit crop of the state for the season of 1895 was 35,000,000 pounds, 12,000,000 of which were shipped east as dried prunes, making 4,000,000 pounds.

The season of 1898 will furnish more than three times the

amount of that of 1895. Careful estimates place the exports of fresh fruits as follows: Apples, 500 cars; prunes, 150 cars; pears, 100 cars; plums, 75 cars, and strawberries, 75 cars. Evaporated fruit: Prunes, 700 cars of 24,000 pounds each; apples, 2,100,000 pounds. Over 20 tons of apple peelings, heretofore thrown away, have been used for jelly, and a most excellent article is made. Still another by product of the orchard is beginning to receive attention—small apples as "chops."

The present and prospective value of the various fruit product has created a necessity for voluntary organization among producers in order that standards of quality may be adopted, and uniformity in the use of packages, methods of handling, and all points necessary to the general adoption of the best methods of marketing agreed upon.

There is, as already intimated, another matter in this connection that depends upon voluntary personal determined effort on the part of the orchardist. California experience, and our own, so far as we have gone, indicates plainly that no orchardist is likely to be long immune from loss by insect or fungoid pests without the use of active, intelligent means of destrying them as they invade his domain.

A paper recently from the pen of Professor Woodward, of the university of California, found elsewhere in this report, gives the views of a painstaking observer on the question of complete eradication of these pests. They can be held in check where and when they are few. They can be largely destroyed where they have become so numerous as to threaten destruction to the interest they attack; but the guards against them must not sleep, nor the weapons of warfare against them allowed to rust As well may the grain farmer omit to vitrol his wheat seed and expect a clean crop, as to expect that the San Jose scale or the codlin moth is not going to reach his orchard. The importance of the fruit-growing interest to the state as a community, is of such importance that the negligent owner of an orchard producing defective fruit should be forbidden to offer it in market at any price. The difference between $1 per box of 45 pounds, and 20 cents per 100, was the price realized this season at Salem between sound, perfect apples and the defective, blemished product from the same trees. The local markets are over-supplied with blemished fruit, and the time has come when each county should have an inspector with legal power to prevent the sale of much if not most of such produce as is now

offered. The shipment of blemished fruit out of the state ought to be imperatively forbidden.

At this present time, though the means of securing 95 per cent. of the produce of any orchard unblemished is furnished free by this board on application, the fruit really fit to export from the state is produced by a comparatively few growers, and these are men who employ the largest amount of intelligence and capital combined in this line of production.

The most important want in this state at present to aid orchardists is a public inspector of chemicals used in spray compositions to cleanse orchards and hopyards. The adulterations of such poisons as paris green is so common that intelligent orchardists will not purchase the article without having it tested. The firm of LaSelle and Son brought this condition of the adulteration plainly to the public eye when they said they instructed their agent to say they would pay full price for the adulterant separate from the Paris green. They succeeded in saving their fruit by getting Paris green pure.

THE MOISTURE REQUIREMENTS OF TREES.

The season of 1898 has been a very dry one as compared with the average or normal season in California. In some districts trees were lost by the drought, in others the trees were saved by great effort, but their fruit lost or rendered worthless for merchantable use. The falling off in cured fruits, of peaches, prunes, pears, apricots, dried grapes, apples, figs, plums and nectarines, aggregates over 90,000,000 pounds less than the production of 1897. In Oregon the effects of this drought seemed to affect unfavorably one kind of prune, the French or petite, a variety prone to overbearing, a characteristic it maintained in 1898, so that much fruit of that variety did not reach the standard of size satisfactory to growers, and was lost or fed to pigs. On the other hand, the season's influence on the hopplant and its enemy, the hop aphis, was that while it lessened the weight of yield in neglected yards, and some that were not neglected (as I may show in a separate paper), the quality of the hops grown was much improved, as was the quality of the peach crop also.

While, then, a dry season in Western Oregon may be unfavorable to some species of crop and some particular varieties of fruit, the fact will remain that a lack of drainage of some soils and locations is now one of the most common

causes of trouble in orchards on low, flat lands. The question of sufficiency of moisture is an important one in the eastern half of this state.

The question of soil moisture has already largely engaged the attention of many of the experiment stations in and near the arid land states. It has the past summer, as already stated, seriously affected some districts of California, and greatly diminished the season's yield of several of her important commercial fruits. The effect on her animal industries has been even more disastrous and costly, her farmers being reduced to the necessity, in many districts, to either purchase forage at high rates or move their stock great distances in order to reach wild or mountain pasturage. The same causes have had a noticeable effect upon the crops and pasturage in Eastern Oregon, and naturally some of the young orchards being planted in that portion of the state have suffered in consequence.

As of value to those who have young orchards or contemplate planting, bulletin No. 121, of the university of California experiment station (published entire in another portion of this report), is commended. Such work from such sources become common property, and are "bows of promise" of a time approaching that will bring the scientist and worker into closer relations with each other. In hopes of contributing something tending to that desirable end, the following is submitted from the standpoint of practical observation:—

Science informs us that a crop of hay yielding 2 tons per acre weighs, when fresh cut, about 6½ tons, ordinary grasses being about 70 per cent. water when cut for hay. The same estimate is made of water constituents of a green tree.

L. T. Reynolds, member of this board for the second district, finds one bushel of French prunes weighs 60 pounds and 20 pounds when dried for market, at which time they still contain 12 to 14 per cent. of water. This gives about 86 pounds of water from a tree yielding 2 bushels. Allowing this as the average yield of 108 trees per acre, we have 9,288 pounds of water in the fruit per acre. It would be a moderate estimate to assume the roots, trees and leaves contain double the water of the fruit, which would bring the water held in the wood tissue and fruit of an acre of healthy prune orchard to 27,884 pounds, about three times the quantity present in the acre of meadow grass. We must concede that this is a moderate estimate when we consider the difference between the height of

the trees as compared with the grass and probable extent of the roots.

The conclusion naturally follows that orchards should have such a depth of soil as would hold within reach of the roots water sufficient to perfect such a crop of fruit. It is also a natural question to ask: Will not the requirement of such an orchard (and still more if the trees should be large apples or pears) withhold a much greater proportion of the water which falls on the surface from reaching the neighboring springs or streams, both by what they hold in their tissue and what they respire through their leaves? Here, the member of the board for the first district remarks: "But we always find moisture near the roots of trees." To which I reply: "Yes, because it is the law of life of trees to attract water from the surrounding soil by their feeding roots, which seems to have the functions in tree life the stomach performs in man; consequently, moisture at the roots of a living tree is as much a requirement of its life as it is that moisture be in the stomach of a living man." Complete dryness would be death in either case, and the water should be healthy water in either case to maintain healthy life. There is, perhaps, no more general or patent cause of death to orchard trees than the lack of drainage of flat, tenacious soils, in which the water becomes dead and poisonous from lack of movement.

It may seem a far-fetched and almost absurd idea to assume similar effects to the human organism and to trees from feeding on poisonous substances or drinking poisonous water, but there is not so much difference in the composition of the bodies of healthy men and healthy trees as there may seem. The green tree is, reduced to its elements, 70 per cent. of water, and more as to some kind, like alder. The body of a man weighing 154 pounds contains 84 pounds of pure water. Drinking impure water is one of the commonest causes of poison diseases, typhoid and others. The condition of the trees in the undrained portion of the insane asylum orchard in 1896, mentioned in the first part of this report, resembled in a remarkable manner the condition of the Indian race in the lower Columbia valley 55 years ago, when they were dying in great numbers from blood poison, by filthy life and filthy food. "Like a tree planted by rivers of water, that bringeth forth his fruit in his season, his leaf, also, shall not wither" is the beautiful simile between a man of healthy, moral life and a tree planted in healthy conditions. The figure can be reversed.

In attempting to give an estimate of the horticultural results of 1898, I wish to premise by saying that it is only an estimate, as the rules generally followed by the leading transportation companies preclude the possibility of exactitude for some months yet.

I may say, also, that the general interest in horticultural crops, and, I may add, the general hopefulness of those devoted to this line of industry, was never stronger in Oregon since the pioneer days of the industry transit as at the present time.

A careful estimate places this year's output of cured prunes at 700 carloads of 24,000 pounds, equaling 16,800,000 pounds; evaporated apples, 6 cars, 150,000 pounds; fresh or green apples, 500 carloads, 11,250,000 pounds; fresh or green prunes, 150 carloads, 3,750,000 pounds; fresh pears, 100 carloads, 2,500,000 pounds; fresh prunes, 75 carloads, 1,875,000 pounds; strawberries, 75 carloads (not weighed); a total of 1,606 carloads of green and dried fruits. The cured prune crop alone, at 3⅛ cents per pound, amounts to $525,000, and dried apples at 5½ cents, equals $82,500. As a by-product of the latter, 20 tons of apple pealings, heretofore thrown away, have been used in making an excellent article of jelly, and, in addition this season, small apples have been utilized as "chops" and exported.

Orchardists producing 90 per cent. or more of apples of the first class, have not all adopted means of putting the smaller percentage of their by-product into condition for export; and some sold that portion of their produce as low as 20 cents per 100 pounds. The prices of fresh apples have thus ranged from the price of the most inferior class to $1 per box or bushel of 45 pounds, free on board.

An interesting feature of the present condition is the general interest in and extending area of fruit production. Not only single orchardists have in this season of 1898 surpassed their previous seasons greatly in the amounts and value of their contributions to general commerce, but localities never before entering into the export movement of fruits have made important beginnings.

Thousands of boxes of fine apples have been sent to California from the southwest coast of our state. The Yaquina valley is beginning to add something to the trade.

Passing entirely over what has heretofore been deemed the fruit-producing districts of Oregon, we find the choicest samples of the choicest fruits produced in the northeast corner of

the state, the small valleys making up into the highlands of Wallowa and Union counties. One of these in the latter county, known as Eagle valley, 3,000 feet above sea level, gives an estimate production of 400,000 pounds of fruit and 120,000 pounds of honey, while the most of its open land of twenty-one sections is producing great crops of alfalfa hay for the wintering of the livestock, which is the chief resource of the people. These fields of production may be yet too far from transportation to swell the state's production now, but it is noted at Cove, in the same county, one of the pioneer settlers reports: "We have a fruit evaporator of fifty tons' capacity contributing to swell the prune output, and a distillery for the smaller refused fruit, making apple, prune and peach brandies."

In all the older fruit-producing districts extensive additions for curing fruits have been made. In the Willamette valley it is estimated more than 100 driers have been constructed this year as the effect of the increased prune crop alone. But the increased attention to drying apples is fully as marked as that devoted to the prune crop. As to the fresh fruit, the marked increase of that is, in part, owing to a short crop in the middle west and a change in business methods with reference to winter apples. Capital is being invested in the distribution of deciduous fruits that can be sold fresh in winter. The dealer seeks the producer now. He wants the best and no other; and he wants them unblemished and unbruised. Here are a few of the results: An orchard near Salem, planted by the late R. S. Wallace, contains 2,700 Esopus Spitzenburg trees virtually bearing their first crop. One dollar per box of 45 pounds is offered for the unblemished product, and from these trees alone 2,800 boxes are exported, where 30 boxes only were secured last year. The owner of another orchard near Grants Pass, Hon. H. B. Miller, is known to give good care to his fruit. The buyer seeks him out, gives him 75 cents per bushel and superintends the picking and packing.

The member of this board for the fourth district, in which Grants Pass is, writes: "I find them (the orchards) in much better condition than when I last visited them. I find also they (the owners) are getting good prices for their fruit. Weeks and Orr, near Medford, have sold seven carloads of apples to go to Liverpool, England, for which they receive $1.25 per box at Medford. They are drying 100 boxes of culls per day, and Mr. Kleinhamer has sold his at Medford for 90 cents per box."

The examples of these leading orchardists all over the state stimulates the greater number of less prominent growers to use the same means of producing unblemished fruit to such an extent that Commissioner Casey found among them a very general concern to secure free from adulteration the chemicals most effective in destroying the codlin moth. Nearly one month after the writing of the above extracts he visited in the northern portion of his district 170 orchardists, cultivating an aggregate of 3,408 acres, which, he says, gives a slight idea of the orchards in the Umpqua valley.

It is the streams of production coming into the lines of commerce, mainly for the first time in our history, which makes it impossible yet to say whether the foregoing estimates are not below rather than above this season's output. This can be relied upon. It is not one tenth of what Western Oregon alone can do in fruit production and not burden one single family with a water tax for irrigation purposes.

THE HOP CROP AND ITS VALUE.

I close this paper with a brief summary of the hop harvest, the marketing of which is nearly finished. I included it because, as a condenser of land values and distributor of income from the soil, as well as from the measure of intelligence, care and skill in producing the crop ready for the market, I believe hop culture more properly belongs to horticulture than to agriculture.

By men whose business it is to be informed, the hop crop of Oregon is estimated at 67,500 bales, of the average value of 13½ cents per pound. At the usual estimate of 180 pounds net per bale, this makes the money value of this crop $1,640,250.

Circumstances have made me acquainted with the cash income from a 25-acre hopyard sold at slightly above 13½ cents. The cash receipts were $5,890.18. The outlay for labor, supplies, insurance, etc., was $3,786.18, leaving $2,104 as the cash earnings of land, plant and buildings for the season.

JOHN MINTO.

REPORT OF THE COMMISSIONER

FIRST DISTRICT.

FIRST QUARTERLY REPORT.

He who thinks he can find within himself the means of doing without others is much mistaken, but he who thinks that others cannot do without him is still more mistaken.— ROCHEFOUCAULD.

HILLSDALE, June 17, 1895.

To the president and members of state board of horticulture:

Herewith I beg to hand you my first quarterly report. I have visited the cities of Newberg, Dundee, Dayton, Lafayette, McMinnville, Sheridan, Willamina, Bellevue, Amity, Wheatland and environments, taking in all the orchards and home places between cities, and as many of the byways as I could see or hear of, in all one hundred and forty orchards and farms (as per detailed report hereto attached), besides visiting many home orchards of one acre or less, of which I have kept no memorandum, though found that the owners of these home places are just as anxious and willing to learn as those of larger acreage. I was very much gratified to notice that a great deal more work had been done by way of pruning, cultivating and spraying this year, especially in old orchards, than ever before, but I do not attribute this altogether to the educational work done by this board in the past, but much is due to the press throughout my district, who so kindly have taken hold of this matter by disseminating all kinds of news likely to benefit the orchardist, and also to our new law. Owners of old, dilapidated orchards realize that they must be up and doing, and if they fail to do so, somebody will do it for them at a much greater expense than if done by themselves. In visiting these orchards I invariably looked up the owner and accompanied him into his orchard, and, if an old one, one of the first questions usually asked me is: "What are you going to do with my old orchard—going to have it cut down?" And then they seem quite surprised when I tell them that my mission is one of peace and education first, and

of war only as an extreme measure. I would then show them the various insects and fungi which existed, and explain how, by judicious pruning, cultivating, and spraying with the proper washes, his orchard would again become a source of profit, and to those of younger and growing orchards, which, by the way, were in uniformly good condition, I also explained these points, and as most of these orchards carried too much wood, showed them how to prune by pruning several trees as samples to go by, next fall pruning, all of which was gratefully accepted, and, in fact, everywhere I was most cordially received, and such expressions as "I heard you were around and am glad you called; I want to learn; and, I thank you for your information," which was very gratifying, indeed. I would then present each one with a copy of our new law, rules and regulations, and the various sprays, so no ignorance can possibly be claimed by anyone.

I found that most of the younger orchards have been over-cultivated, which I hold is a great error; as these young trees make an abnormal growth, and are more liable to the attacks of parasitic fungi, as Professor Pierce calls it, and also to soursap, or winterkill, the most thrifty looking trees being first attacked. I have now in mind a 70-acre prune orchard which has thus been injured by too kind treatment. Over thirty per cent. of these four-year-old trees were infected with this parasitic fungus, and it will take a good deal of hard work cutting out the spots and spraying to save them. (Under the treatment recommended by me at that time, eighteen months ago, the trees came through all right.)

In allowing too much wood to remain on the trees, or, in other words, not pruning sufficiently, I saw a prune orchard near Newberg of twelve acres of ten-year-old trees, laden with prunes, all rotting. These trees had three times as much wood as they should have had. The dense foliage held the moisture, and the prunes rotted in consequence. Had these trees been properly pruned so the sunlight could have shown in and the air circulated through them, the orchard would have yielded not less than $1,500 worth of prunes, while in its present condition it will not realize a dollar; and, strange as it may seem, it is hard work to convince owners of this fact.

Speaking of prunes rotting, as reported in the Oregonian from elsewhere, I desire to state that my observation leads me to the belief that wherever trees have been properly pruned, no rot occurred, while on trees not sufficiently pruned they

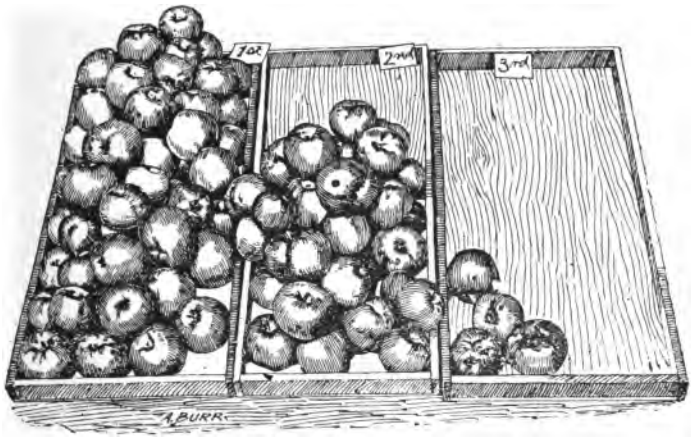
show rot all over, and often in orchards standing alongside of each other; hence I have taken great pains in showing these young orchardists how to prune their trees for profit.

Occasionally, I find an unbeliever in the effect, or rather good results, obtained from spraying. A gentleman near Dayton, who has a 40-acre old apple orchard, which at my first visit was literallly overrun with caterpillars,—millions of them in all directions,—I advised him to spray at once with our spray No. 10; so his son took hold of it at once and began spraying under my direction. About four days later I again called to see the effect. Finding no one in the orchard, the spraying tank and pump standing idle at the barn, I concluded something had gone wrong, and drove to town near by to hunt him up. I found him rather discouraged; the caterpillars were not dying, so he quit. I made him jump into my buggy and drove back to his orchard, and when we came to where he had quit the day before, he pointed to the caterpillars, seemingly as lively as ever, which I expected, so I asked him to go where he had commenced. When we came near, the ground was covered with dead caterpillars, many hanging down on their webs in midair, seemingly meditating if they should allow the sun to dry them up or fall to the ground and let the rain bury them. I then explained to him that the paris green sprayed on the leaves was so little that it took two or three days feeding for them to get enough to kill them. Of course, he started the pump again, and when I called three weeks later I found all the caterpillars dead, and his fine horses grazing in the orchard.

Of diseases, I found deadspot or apple canker, soursap, gummosis and other fungi, green and woolly aphis, pear-leaf blister mites (which latter had been sprayed, and were dead), twig borers (which enter the new growth at the end and work down the center until they reach last year's growth, when they emerge from the side), a minute, light brown beetle (which girdles the fruit spurs on prune trees), and in one orchard only San Jose scale, the trees of which came originally from Wirt Brothers, of Salem, so I wrote to Mr. Minto at once to inspect the nursery. He found that it had changed owners, and the present parties had burned up all the old stock, and their nursery is now reported clean by Mr. Minto.

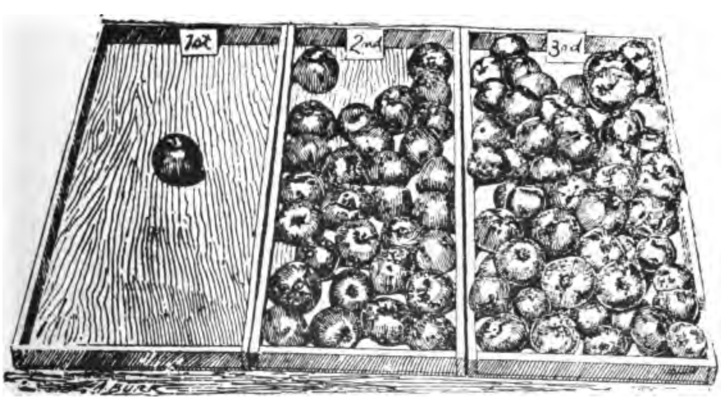
In my report last summer I reported that I had come across a fly or beetle feeding on green and woolly aphis. I again found this beetle in many localities, and in larger numbers. I watched more particularly in the apple orchard on

FIGURE 3.



FALL PIPPIN.
Sprayed six times with Bordeaux Mixture. First, second, and third grades

FIGURE 4.



FALL PIPPIN.
Not sprayed. Showing first, second, and third grades

Broadmead, owned by Mr. Ladd, and also on the 50-acre apple orchard of Mrs. Robinson. Whole flocks of them would alight on the trees and in a very few minutes every green and woolly aphis had disappeared. They are ravenous feeders, and our old friends, the "ladybirds," numerous as they are, are not "in it" alongside of them. I submitted samples of them to Professor Washburn, of the experiment station, and he names them "*Podabrus comes*, family *Lampyridæ*," and has no common name. I found a few oak grubs, about two inches long, in an Italian prune tree, but as the orchard is surrounded by oak timber, they may have found their way into this prune tree accidentally.

Our friend, Mr. C. E. Hoskins, called my attention to curl-leaf on the cherry trees in his orchard, the first he had noticed, though I found this same curl-leaf in several cherry orchards afterward, but only in isolated cases, and do not consider it serious. My observation leads me to the conclusion that hereafter all our orchard trees must be sprayed in the fall after the leaves have dropped as well as in spring. Five years ago I said in my report that "eternal spraying is the price of good fruit," and I regret to state that I am of the same opinion still.

Before concluding permit me to refer to so many complaints in and about Portland. I have followed up all complaints made, and, while some have merit, the majority are of the most frivilous nature. Parties complaining seem to be under the impression that wherever there is a caterpillar the commissioner must be summoned with a squirtgun and kill the intruder. To illustrate, a lady made a complaint about a Pleasant Home place, owned by Mr. Cameron, on the base line road, and other neighboring places. Upon close inspection I found only one caterpillar nest, the orchard having been cleaned and was in good order, and upon inquiry found it to be spitework over a right of way; another lady complained about caterpillars on trees adjoining her backyard. On examination I found just four sickly young cherry trees with a few caterpillars, which she could have killed in less time than it took her to go to our office and make complaint. There are many other similar instances. While I recognize the right of owners of nice home places against those of their neighbors who do not care, I do not think the law governing our board contemplates the spending of so much time and money in this direction, especially in the cases cited. Last year I spent a good deal of time in this

city and across the river, and explained to hundreds how to prevent the recurrence of this nuisance. I had a great many old trees cut down and burned, and it seems to me they should have profited by it. This year I propose to spend what little money is allotted to my district in the field, among the orchardists, where I think the legislature expects it to be spent, and where, no doubt, the state will derive the most profit.

I have now given Yamhill county all the time I possibly could, except a small portion of Newberg and northwest of Dundee, which I shall take in in my next trip through Washington county. You will notice from my detailed report the many places visited each day, that I did not allow the grass to grow under my feet, yet I gave each orchardist all the time necessary and did not neglect anyone; but I had to do this in order to visit as many places as possible. Seven o'clock in the morning usually found me on the road and seldom stopped before 7 o'clock in the evening.

In conclusion, I may mention that all orchardists, especially those owning old apple trees, were informed that the quarantine rules regarding wormy and scabby fruit would be enforced and all fruits so infected would be condemned.

Henry E. Dosch

Commissioner, first district.

SECOND QUARTERLY REPORT.

When you have done a kindness, and your neighbor is the better for it, why need you be so foolish as to look any further and gape for reputation and requital?—MARCUS AURELIUS.

HILLSDALE, September 9, 1895.

To the president and members of state board of horticulture:

I have the honor to present to you herewith my second quarterly report. I have visited Oregon City (hill and river route), New Era, Barlow, Aurora, Woodburn, Gervais, Brooks and Salem, by invitation of Mr. John Minto, commissioner of the second district, parts of Mount Tabor, Stone's, Thibbet's, Simon's and Brush's addition to Portland, Tigardville, Taylor's Bridge, Tualatin, Durham's Mill, Waverly, Ivanhoe,

Richmond and Woodstock; also attended, by invitation, the meeting of Columbia county horticultural society, at Hudson's schoolhouse, near Ranier, and Yamhill county horticultural society, held at Lafayette. One of my observations, which impressed itself most on my mind during these trips, and I sincerely regret to state it, was, that many orchards are giving way to the hopyard. These fruit-growers have become dispirited by the low prices which prevailed during several years past and have either utterly neglected their orchards or have grubbed them up and planted hopvines, certainly a great mistake. While it may be advisable to grow hops alongside of fruit, by way of diversified farming, it certainly is ill-advised to abandon the orchard for the hopyard. The progressive orchardist, who keeps abreast of the times by reading horticultural papers, is not caught that way. He keeps on pruning and spraying and this year will again receive fair prices for all kinds of fruit, and I dare say that many of the former regret their rash action. It is but a question of a few years, and I do not fear successful contradiction, when I assert that hops will be cheaper and require more labor, care and spraying to produce than fruit. As civilization progresses and people learn how to live, the consumption of fruit increases, while the use of hops decreases. The general depression will soon pass away and everybody will buy and eat fruit, while hops are used only in one line extensively and even in this line less and less every year. The man who will stick to his orchard and produce good, clean, marketable fruit will be the successful one in the end.

On the other hand, I desire to report that I have seen many fine young orchards, ranging from 30 acres to 2,000 acres, the latter being owned by the Oregon Fruit and Land Company, of Salem. However, many of these growing orchards have been over-cultivated and too much wood allowed to grow, to the detriment of trunk and roots, thereby weakening the trees and they are more susceptible to the attacks of disease. These orchards are from 2 to 5 years old and planted by progressive orchardists, who are strong supporters of the new law and insist that the old pest-breeding places must be destroyed. The owners of the latter orchards are generally prejudiced and pessimistic people, opposed to law and progress, who do not read any horticultural papers or our Oregonian — not even their own county paper — but upon looking on the center table you will find some eastern 25-cent-a-year sensational story paper, which befogs the minds

of the old and poisons the minds of the young. It is very gratifying to report the great interest the ladies take in orchard work, and wherever they have control the orchard is really in good order and they welcome our visits, being eager to learn; but whenever their orchards are neglected they apologize for it with a shrug of the shoulders, as much as to say: "I cannot do it all"; and, no doubt, they are right. The tobacco-spattered porch and whittled-off benches and chairs give silent testimony.

My visit to Marion county was principally on invitation from Mr. Minto, to assist him in examining the many young orchards which seemed diseased, and I found much more serious trouble than I anticipated. Quite a good percentage of the young trees show unmistakable evidence of canker or deadspot, but the principal infection is gummosis or gum disease, to which all drupaçeous trees are subject. Professor Pierce tells us that the Germans have studied this disease extensively, but they have failed to assign any direct or specific cause. Both these diseases are of a fungus nature and there is but one remedy given, to-wit: "Cut out the diseased spots and spray with bordeaux mixture." The enemy is here and the sooner we fight him the better, or we will lose our trees. I have two cherry trees on my grounds which are living evidences of this treatment. One twenty-year-old Royal Anne gummed so profusely that the top died down. I cut it off, as well as the gum pockets on the body, and sprayed with bordeaux mixture and the following year it grew a new head and this year was laden with fine fruit and is healthier than its neighbors. Another is a Bing cherry, given to me by a friend. It never made any growth, though four years old at the time of planting. It made a sickly attempt every year for three years without success. On close examination, I discovered both canker and gummosis, one side being dead from root to branches and halfway round. I carefully cut out all the dead bark and spores, sprayed it twice thoroughly with bordeaux mixture, double strength, and this year it made four feet growth. The bark is gradually growing over the wound, and it even bore some very fine cherries.

Again, take the famous Wallace pear orchard, near Salem, which was very badly infected with canker or deadspot; but spraying checked it and no new spots could I discover this season. Had they used the knife, which no doubt they will this winter, they would have vanquished the foe entirely. Further than that, even by this same spraying, they checked

the scab on the fruit spurs so that the pears were perfectly clean and free from fungus growth and, in consequence, they sold the whole output—some five carloads—at 87½ cents per box, freight on board, at Salem, while unsprayed and scabby pears were unsalable. Further comment seems unnecessary.

Agreeable with our resolution to attend the meetings of the horticultural societies, I answered a call from Columbia county to address them on horticultural subjects. I expected to occupy only a part of the programme, but when I reached the place of meeting I was informed that the whole evening had been set aside for me. This was rather unexpected, but I soon discovered that they were mostly new beginners and as one lady remarked, "You tell us all about it, from clearing the land to plowing, laying out, selecting and planting the trees, varieties, pruning from year to year, cultivating, evaporating and to final marketing of our fruits, and we will be pleased." I undertook this task to the best of my ability and when, after some time, I looked at my watch, I found I had talked nearly three hours, and it affords me great pleasure to state that I seldom had a more interested and attentive audience, fully one third being ladies. They were very profuse in their thanks for coming in the midst of their heavy timbered mountain homes to enlighten them on this very important subject.

In my report three months ago I predicted a heavy prune crop, which has been verified, and I doubt if any other country can make such a showing. Two-year-old Italian prune trees have from 3 to 5 pounds each; three-year-old trees average 7 to 10 pounds each; four-year-old trees, 20 pounds each of very fine fruit; older trees in proportion, especially on the red hill lands of Yamhill, Polk and Marion counties.

A gentleman who visited my orchard recently, and who had just returned from Europe, informed me that the French people placed last year on the market a very fine article of prunes, being pitted and skinned. He tells me that it is a most excellent fruit to eat out of hand or prepared for table use. It occurred to me that these thrifty people, seeing the American market gradually supplied by the Pacific coast states and their trade for ordinary fruit slipping away from them, propose to supply it with a finer article. Why cannot we do the same thing? If there is a market for such fruit, Oregon with its large French prunes can defy all competition in any line; but we must prepare our fruits likewise; put them

in merchantable packages, properly graded and generally made palatable, so to speak.

Of new insects which came under my observation there were: *Thricolepsis inornata*, a beetle, which I found girdling new fruit spurs and twigs on small prune trees and which Professor Washburn kindly named for me; *Corythura arcuata*, or Hawthorn tingis, which I discovered in large numbers on the leaves of apple trees, giving them a gummy, sooty appearance, withering up and finally falling off; *Aleyrodes* (family and classed with *Coccidæ*), a hothouse scale, which I found on some ferns imported by steamer from Menlo Park nursery, California; specimens of the two last named insects I sent to Professor Craw, quarantine officer of the state board of horticulture, San Francisco, who kindly named them for me, and says that the scale will not spread outside of hothouses. They are easily destroyed, while the other two will succumb to the spraying of paris green.

Before closing my report I desire to call your attention to an error that exists regarding the pay of the commissioners. Quite a number of fruit-growers and others to whom I have talked on this subject are under the impression that the commissioners receive a salary of from $1,200 to $1,500 per annum, and they are quite surprised when I tell them that each commissioner has only about $500 per year at his command. Out of this sum he must pay all his railroad fares (no passes being given), team hire, hotel and stable bills, and all other expenses incurred attending meetings, and what is left he may credit to himself, the law allowing $3 per day when actually engaged in work.

Henry E. Dosch

Commissioner, first district.

THIRD QUARTERLY REPORT.

There is no action of man in this life which is not the beginning of so long a chain of consequences as that no human providence is high enough to give us a prospect to the end.—THOMAS OF MALMESBURY.

HILLSDALE, October 15, 1895.

To the president and members of state board of horticulture:

Permit me to present to you herewith my third quarterly report. Since my last report I have visited Hillsboro, Greenville, Manning, Buxton, Vernonia, Pittsburg, Rock Creek, Pebble Creek, Centreville and Glencoe; having visited this season 314 orchards in all, ranging from 3 acres to 2,000 acres in extent. For details as to acreage, owners, varieties planted and condition in which they were found, I respectfully refer you to the itemized report submitted herewith. In my two former reports I have set forth my observations and suggestions as they occurred, and do not deem it necessary to repeat. I have received to date 257 letters of inquiry, covering all manner of questions relating to horticulture, all of which have been answered, some requiring many sheets. During the month of September,—fruit evaporating season,—some 40 fruit-growers (and over 200 during the summer), called at my home for information, more particularly about fruit evaporation and evaporators in general. All of them have been entertained and the desired information given. My more recent trip has been to the Nehalem valley and its tributaries, Rock and Pebble creeks, having received many requests to visit that locality. These valleys are situated about 65 miles northwest from Portland, and are reached by way of Derry creek, over the 3,000 feet high Nehalem mountains. The road is rather steep and at times the grades are very narrow around cliffs, and leads through heavy but fine timber, principally fir and cedar, many trees being 6 feet in diameter and from 100 to 150 feet to the first limbs. It took two days' hard driving to reach Vernonia, the only village in this so-called valley, which resembles more a canyon than a valley, there being little bottom land. In most places the heavy timbered mountain sides rise from the edge of the river on both sides, only small flats scattered along, on which the houses of the settlers are found. The people in these valleys settled there during the boom of the promised Astoria railroad, which failed to materialize. Having cleared by very hard labor small patches of land, they

are now raising some fine vegetables and some fruit, which is also of first quality. The fruit trees are doing extremely well, and, feeling encouraged by this, they are preparing to set out larger orchards, hence my visit was more of education than inspection. Most owners, being novices in fruit-growing, hailed my coming with considerable pleasure, and made me doubly welcome, as they needed information in every branch of horticulture, which, of course, was cheerfully given, particularly that part pertaining to pollination, which was very much of a surprise to them, and, in fact, is but little understood by older orchardists. You will see, from the detailed report herewith submitted, that a few trees are old enough to bear fruit, principally apples and prunes, which were of very fine quality and as yet free from fungus diseases.

Insects they have about the same as elsewhere, except the codlin moth, which only made its appearance in two places this year for the first time. But all realize that they must spray hereafter for good, sound fruit. One of the most common errors I find nearly everywhere is over-cultivation and the growing of too much wood or head in young and not yet bearing orchards, most owners being too anxious to have fruit as soon as possible. This is a serious mistake, and I always take great pains in showing beginners, and older ones, too, how to properly prune their trees and cultivate their orchards. I received many inquiries and am often asked the question where to purchase nursery stock free from disease. It is not proper for us to recommend any particular nursery or nurseries, and I never do. But I tell them that if I wanted to buy young trees I would deal with those only who sprayed their stock and subjected them to some strong disinfecting solution or hydrocyanic acid gas bath before sending out. If these suggestions were followed out many diseases would be stamped out in a few years or at least checked. (At the request of nurserymen a law governing nursery stock has since been passed.)

Though not in my line, I desire to mention an observation which speaks volumes for our rural communities. That is, the many schoolhouses one sees at every hand, not alone in the settled portions of our beautiful valleys, but in isolated places. On the mountains and hillsides, wherever a few families have settled, you are certain to find a schoolhouse. True, many are but primitive structures and not the palatial and very expensive buildings of our cities. But it is not the house that brings education. Please bear in mind that most

of our illustrious men and women were educated in the old log schoolhouse.

Before closing my report I beg to call attention to the misleading statements that find their way into the press constantly about the disappearance of this or that insect or fungi. Whether these reports are made through ignorance or for malicious reasons I am not able to tell, but certain it is that they do a good deal of harm, as those who do not care to spray shield themselves behind these reports, thinking it unnecessary expense. The Oregonian, usually very careful, had an editorial recently, stating that "the woolly aphis was disappearing fast." On the contrary, they were never more numerous than just at this time. Whoever gave the paper this item either did not know what he was talking about or had some reason of his own for giving it. I reported the appearance of a beetle *(Podabrus comes)* in many localities during the spring, devouring the woolly and green aphis as soon as they appeared, but these beetles leave us during the summer, and the aphid family have full sway unless checked by the spray pump. It is scarcely necessary to add that throughout my district the fruit crop has been very abundant and harvested in good condition. While prices rule low, nevertheless it will be a great help to many small growers to tide over the winter.

Henry E. Dosch

Commissioner, first district.

FOURTH QUARTERLY REPORT.

Exert your talents and distinguish yourself, and don't think of retiring from the world until the world will be sorry that you retire. I hate a fellow whom pride or cowardice or laziness drives into a corner, and who does nothing while he is there but sit and growl. Let him come out, as I do, and bark.—DR. JOHNSON.

HILLSDALE, December 7, 1895.

To the president and members of state board of horticulture:

I beg to present to you herewith my fourth quarterly report for the current year, which about completes the work done in my district. Since my last report I visited Reedville, Hills-

boro, Cornelius, Forest Grove, Dilley, Gaston, North Yamhill, Carlton, Oswego, Columbia slough and environments, as per detailed report of each place visited hereto attached. I have also inspected 21 nurseries, most of which were in very good order, and issued certificates to all, except one at Canby, from which the diseased trees were shipped into Eastern Oregon last spring, before nursery inspection became a law.

We have now given seven years of our best thoughts and careful study along the line of horticulture in all its various phases and branches. We have done a good deal of patient, painstaking, educational work in the field, and all fruit-growers should now be fully conversant with and know how to care for their orchards and fruits. I said we have been very patient in the execution of our law, but the time has arrived when we must call a "halt"; it is due to the progressive fruit-grower and the state at large. The don't-care-a-whoop sort of orchardist must take notice that vigorous measures will be adopted another season. Now is the time to renovate old orchards, to prune out dead limbs, and spray the trees to destroy insect larvæ and clean them of the moss. All orchards found neglected and uncared for next spring will be placed under quarantine, in accordance with section 7 of the horticultural law; but I sincerely hope that we shall not be forced to use such extreme measures.

In a former report I said that it was a mistake to cease planting fruit trees or grub up growing orchards and plant the ground to hops. I was severely criticized and hauled over the coals, as it were, but events proved that I was correct. In fact, I find, after careful inquiry, in all the towns in my district, that those who had any fruit to sell were the only ones who had any money to buy necessaries and even luxuries this fall. Where is your hop-grower who was promised eight to ten cents per pound for his hops? He actually sold and received only five to six cents per pound, which is less than they can be produced for. I further said, that notwithstanding the increase of population and consequent consumption of beer (the only principal product in which hops are used), the use of hops was declining. In order to corroborate my statement I asked two of our largest eastern hop-buyers to give me their opinions, and their answers confirmed my assertion, "that formerly in the manufacture of beer, which had to lie in cellars six or seven months before it was ready for consumption, brewers used one and three fourths to two pounds of hops per barrel, while now, with improved machin-

ery, chemical processes and ice machines, only five eighths to three fourths of a pound of hops are used per barrel." One of them even said that he knew beer to have been brewed in New York without any hops. On the other hand, my friends, the hop-growers, confront me with this remark: "Fruit-growing, at the low prices ruling, does not pay any better." Let us look into this. I have said that as we become more civilized and educated, the consumption of fruit —the natural food for man—will increase, and good prices will be realized. Time alone will fully answer the first part, although fruit consumption is increasing daily even in our own homes. As to prices, we know that even poor apples sold readily for 50 to 60 cents per box, and choice for $1.25 per box, and by Christmas will bring $2 per box.

Then take prunes, which will be our principal crop in the near future. I sold my French prunes at the low figure of 3¼ cents per pound, in sacks, which is possibly lower than they will ever be again, and yet they brought me $131.80 per acre. Deduct from this for picking, hauling, grading, evaporating, cultivation, etc., and interest on investment, $28.80, and it leaves a net profit of $103 per acre.

Now, take pears. I was offered only 35 cents per box for the very best ones, and nothing for culls, so I evaporated them all. The yield was 12,000 pounds of fresh fruit per acre, making 2,000 pounds of evaporated product, which I sold, packed in 25-pound boxes, for the low figure of 10 cents per pound, realizing $200 per acre. Now, deduct from this for peeling, picking, boxes and other expenses, as above given, $101.20, and we have a net profit of $99.80 per acre. It seems to me further argument is unnecessary. We have had years, and no doubt will have them again, when prices were better and realized much more per acre; but even at present low prices it is good enough, and even could stand considerable shrinkage and still be profitable.

Henry E. Dosch

Commissioner, first district.

FIFTH QUARTERLY REPORT.

There is no such thing as patriotic art and patriotic science. Both art and science belong, like all things great and good, to the whole world, and can be furthered only by a free and general interchange of ideas among contemporaries, with continual reference to the heritage of the past as it is known to us.—GOETHE.

HILLSDALE, April 13, 1896.

To the president and members of state board of horticulture:

Herewith I present my fifth quarterly report. I have only visited, since my last report, Canby, Milwaukie, Sauvie's island, Willsburg, Beaverton and environments; inspected the fruits arriving in Portland from abroad in 12 carloads and 17 steamers, as well as a few shipments of trees. All were found in good order and condition. I have also inspected 28 nurseries, most of which had been sprayed, and all had prepared sheds for fumigation purposes. These gentlemen realize the necessity of spraying their nursery stock, thus assisting in stamping out, or at least keeping in check, many diseases and insects. All were given to understand that no certificate will be issued unless so sprayed and fumigated. Since our last meeting, I received 378 letters from many places and upon many subjects, and all received the proper replies; a good many inquiries were about nut culture, showing that quite an interest has awakened in that line.

Having spent all my time and funds at my command last year in field work in Yamhill and Washington counties, it is my intention to confine myself this year principally to Clackamas, Multnomah and Columbia counties, with a possible flying visit to Clatsop and Tillamook. It is most gratifying to report the great amount of spraying that has been done this spring. Many old orchards were cleaned up and worthless ones grubbed up entirely, the result of consultation with the owners; and this is as it should be. It is high time that the neighborly feeling, if nothing else, which should exist in all communities, was manifesting itself and owners of old orchards understood that they have no more right to allow their fungus diseases and insects to invade a neighbor's thrifty orchard than to allow their cattle to break into his wheat-field—only the former is more disastrous. But it is pretty generally understood that the law will be enforced if moral suasion fails. However, I am pleased to state that so far every order to clean up has been obeyed. Daniel Webster, a few

years before his death, writing to his grandson, among other advice given, said: "First, you cannot learn without your own efforts. All the teachers in the world can never make a scholar of you, if you do not apply yourself with all your might." It is the same in fruit-growing. All the educational work done by this board and the experiment station is lost unless the individual grower makes a personal effort and studies the various diseases and insects in his own orchard, and applies the proper remedies so bountifully furnished. I desire to call your attention, and owners of pear orchards in particular, to a disease which only recently has been identified by Prof. C. W. Woodworth, of the state university, Berkeley, California, and called the crater-blight of the pear.

I first noticed it in my own orchard, which I grafted over to Bartlett pears some six years ago, the original trees being Beurre Easter, and about 14 years old. Whether it was due to the check given the trees, or some other cause, certain it is that the disease soon made its appearance. The grafts made a wonderful growth, but the following year many of them died back one half and turned black. These were all cut off when pruning time came, but the trees made no growth that year. The following spring they bloomed very full, but before setting fruit these blossoms turned black, as if cut down by frost, withered and dropped off. The bark on the limbs assumed a dull, yellow color. The leaves came out somewhat shyly and remained small, making no headway whatever. During that summer there appeared large, shrunken spots on the trunk of the trees. I was sorely puzzled about this disease, as I could not classify it, though as a precautionary measure we sprayed them with bordeaux mixture with seemingly beneficial results, and had almost come to the conclusion that it was canker or deadspot. Yet there was a noticeable difference. The bark and wood underneath these spots had that complete dead appearance, besides the dead part did not separate into shreds as in canker, but there is a sharp line of demarcation between the dead and live bark. These spots would not spread very much, but others would break out in other parts of the tree, and the following year the trees were dead—completely dead—body, branches and roots. After reading Professor Woodworth's description of this blight, I was certain that my trees were infested with it, and, in order to make sure, I sent large limbs to him for identification, still hoping that this much-dreaded disease did

not exist in Oregon, but in summing up the case in the Pacific Rural Press, San Francisco, of March 21, 1896, which is accompanied by an engraving taken from a photograph of the limbs sent, he says: "The specimens sent are in every respect typical examples of the trouble, and the accompanying cut will be of assistance to readers in the recognition of the disease if they have it in their orchards."

"The crack, or fissure, separating the diseased from the healthy bark, can be seen very distinctly, and also the line between the blight of 1894 and that of 1895. The roughened surface of the bark that died in 1894 shows the subsequent attack of fungi, which flourishes on dead bark. The study of specimens sent by Mr. Dosch leads Professor Craig, who is now in Berkeley, but was formerly botanist at the Oregon station at Corvallis, to conclude the blight is quite widespread in Oregon. Professor Craig formerly diagnosed it in that state as a form of sunscald, but now recognizes its distinctive character as a blight." In a paper read by Mr. Thomas Frazier, of Forest Grove, at the state horticultural society meeting, held April 12, 1888, he speaks of it as the "black or sour blight," and says: "This blight has been the worst foe in raising fruit trees. I have, from year to year, when the bark was in condition to peel, cut out these spots by cutting back to sound wood and bark and then painting the wound over with white lead and raw linseed oil." It will thus be seen that the disease has been here for a long time. Professor Woodworth recommends the pruning back of dying limbs into healthy wood, the cutting out and thorough cleaning of crater spots, and washing with bordeaux mixture. We have lost about 35 twenty-year-old trees, but hope to save the remainder of the orchard by the treatment advised. I have purposely given a minute description, so that owners of pear orchards may readily identify it if their trees are infected, and, as this disease is of a very deadly nature, I earnestly beseech them to examine their trees very closely.

(Since then, Professor Woodworth has made further investigations, and writes under date of July 7, 1896, as follows: "The disease I have described as crater-blight, however, is not a fungus disease at all, but appears to be a true blight, allied to the real pear blight. It even attacks the foliage as well as the stem, but differs from the eastern pear blight in many particulars, especially in its slow rate of progress, and most strikingly by the breaking of the bark, forming a sharp line of demarcation between the diseased spots and the

CUT SHOWING DISEASED LIMBS OF CRATER BLIGHT.

healthy portions of the stem, and when the spot is small making a cratér-like pit, which suggested the name." We have made some progress in the study of the disease, in that we are very uniformly able to obtain pure cultures of a peculiar bacillus. Inoculation experiments have so far given only negative results. In speaking of California, he says: "We have heard from those who have personally examined the cases in the San Joaquin valley that the ravages of the blight are indeed deplorable. Its progress in the interior of the state—California—is apparently much more rapid than near the coast. We have had the same trouble for years in the orchard at Berkeley, but it is not as fatal with us as in the San Joaquin valley.")

A valuable little friend.—Last summer my attention was attracted by a black, glossy and very active little beetle on San Jose scale-infested trees. This beetle is very minute, not larger than a small pinhead, but there were so few of them that I did not examine them closely. This spring, however, I looked for them again in the same locality, and found they had wonderfully increased on those same trees, so I concluded to examine into it more closely, as they evidently were there for good reasons. I held my glass over a few and found them to be devouring the eggs of the San Jose scale. Their mode of operating is to get astraddle of the scale, and with their sharp snout gradually loosen the scale around from the limb, then get down, upset the scale, exposing the eggs, and the feast would begin. They are ravenous feeders, and most interesting to watch. I at once gathered a few and sent them to Prof. A. B. Cordley, entomologist at Corvallis, for identification. He writes me as follows: "The small beetle you send is evidently *Pentilia missella*, a little *Coccinella* beetle, which is one of the most efficient enemies of the San Jose scale in the east. Until recently it was supposed to be a distinctly eastern species, and measures were taken to introduce it into California, but lately it has been found to be abundant in Yuba county, California, and is probably widely distributed on the entire coast. You are to be congratulated on finding such a valuable little friend of the fruit-grower, one which it will undoubtedly pay to distribute widely if further search shows it to be limited in its distribution." Nature has no doubt sent us this little friend for Western Oregon, as the twice-stabbed ladybird, the great devourer of San Jose scale in Eastern Oregon, does not seem to take kindly to our humid climate, and I would therefore ask all fruit-growers to exam-

ine their trees and kindly report to me, if found, and send specimens either to Professor Cordley or myself for identification.

For the benefit of prune-growers I desire to report that upon inquiry it is found that gummosis on prune trees has been successfully treated under advice given, by cutting out gum pockets, lightly splitting of the outer bark on infected trees, and washing with bordeaux mixture. The reason for advising the splitting of the outer bark is that all gum-infected prune trees were found to be barkbound, thus checking the sap flow and aggravating the disease. The splitting will give the sap a free flow, carrying with it the bordeaux mixture, and assist in overcoming the disease.

Horticulture in our public schools.—This subject has been engrossing my mind for many years, though I did not dare to express it, but a recent editorial in the Oregonian gives me the courage to say that it should be introduced in our public schools as one of its studies. Oregon is a horticultural state above all else, and our youth should be taught its beauties, health giving exercise, peaceful minds, and the many other benefits not obtainable in any other pursuit. But thorough education is necessary for success, the lack of which drives many a good boy and happy girl, who with proper knowledge would make good horticulturists (and women make excellent fruit-growers), to the city with its doubtful consequences. It seems to me that we, as a board, should take the initiative by laying this important matter before the proper authorities. In order to make a beginning, I am now having prepared a suitable gold medal for the best essay on fruit-growing to be competed for by the youths of both sexes of the country schools in my horticultural district, the competitors to be between the ages of fourteen and eighteen years, and the essay to contain not more than seven hundred words, the award to be made by three competent judges.

An eye to see nature,
A heart to feel it, and
A resolution that dares to follow it.

Henry E. Dosch

Commissioner, first district.

SIXTH QUARTERLY REPORT.

The law of nature is that a certain quantity of work is necessary to produce a certain quantity of good of any kind whatever. If you want knowledge, you must toil for it; if food, you must toil for it; and if pleasure, you must toil for it.—RUSKIN.

HILLSDALE, October 12, 1896.

To the president and members of state board of horticulture:

I have the honor to present to you herewith my report of the first horticultural district, comprising the counties of Multnomah, Clackamas, Yamhill, Washington, Columbia, Clatsop and Tillamook.

I have visited and inspected during the last two years 731 orchards, which possibly represents one sixth of the area planted to fruit, showing 6,638 acres planted to fruit trees, ranging in age from 1 to 40 years, divided as follows:—

YAMHILL COUNTY.

Two hundred and ten orchards.

	Acres.
Apples	1,023
Pears	165
Prunes	1,622
Cherries	108
Peaches	162
Mixed varieties	102
French walnuts	77
Chestnuts	22
Almonds	12
Grapes	2
Apricots	10

CLACKAMAS COUNTY.

Two hundred and thirty-five orchards.

	Acres.
Apples	805
Pears	141
Prunes	629
Cherries	26
Peaches	41
Mixed varieties	158
Grapes	6
French walnuts	1

MULTNOMAH COUNTY.

One hundred and twenty orchards.

	Acres.
Apples	304
Pears	86
Prunes	201
Cherries	52
Peaches	4
Mixed varieties	58
French walnuts	11
Grapes	2

WASHINGTON COUNTY.

One hundred and eighteen orchards.

	Acres.
Apples	309
Pears	103
Prunes	250
Cherries	23
Peaches	28
Mixed varieties	103
Grapes	94
French walnuts	2

CLATSOP COUNTY.

Sixteen orchards.

	Acres.
Apples	23
Prunes	5
Mixed varieties	17

COLUMBIA COUNTY.

Thirty-two orchards.

	Acres.
Apples	20
Pears	12
Prunes	22
Cherries	1
Mixed varieties	21

For the names of all the owners, postoffice address, acreage, varieties of each and condition in which their orchards were at the time of my visit, I respectfully refer you to the detailed report now on file in the office of our secretary. Also inspected 33 nurseries, which, with the exception of 2, were in excellent order. I have received 1,056 letters from many states and upon all manner of horticultural subjects, which received prompt attention.

Much work has been done by progressive orchardists in pruning, cultivating and spraying, some sections being more enterprising and progressive than others; but, as a general rule, orchards have not received the attention previously given, and the cause of this is accounted for by the very short crop this year, which had a tendency to discourage fruit-growers and make them careless in looking after their trees, which, however, often occurs in other pursuits. But this is a serious mistake. Another year will prove that those who have carefully attended their trees will reap a rich reward, while those who neglected theirs will cry bad luck and regret their indolence when too late. The prospects for a good fruit year are excellent, as all trees are setting heavily to fruit, and with good times coming money will be plenty, fruit will again bring remunerative prices, and Oregon will witness a most prosperous year. "There are no gains without pains," the truth of which is exemplified in the orchard fully as often and to fully as great an extent as in other occupations, but here we are met by the cry of over-production, to which I can only say that as long as Hood River apples sell every spring in the Portland market at from $2.00 to $3.00 cash per box, and little, scrawny, sour apples, imported from Tasmania, have a ready sale at $1.50 per box, there is little danger of over-production in the near future. Last fall I was shown an account of sales by one of our commission houses of several carloads of pears, which were shipped from Southern Oregon. Winter Nellis brought $2.60 per box and a lot of Beurre d'Anjous sold in Boston for $4.80 per box, and yet old croakers say fruit-growing don't pay. Of course it don't pay when the orchard is allowed to run riot and the owner sits around the grocery store talking. But such men as Mr. Stewart, of Southern Oregon, who look after their orchards, properly grade their pears and apples, and put them on the market in a palatable condition, hold different opinions. South says: "He that despairs measures providence by his own little, contracted model."

HORTICULTURAL EDUCATION.

Last May, with a view of creating a horticultural interest among the youths of this state, I offered a gold medal as a prize to the boy or girl, between the ages of 14 and 18, attending any ungraded country school, for the best essay on fruit culture in my district. The essay was not to contain over 700 words, and all papers to be handed in by August 1, 1896, the judges of award to be Dr. J. R. Cardwell, Prof. E. R. Lake and Mr. Frank Lee. I experienced some difficulty in persuading these gentlemen to act, as they anticipated such a flood of essays which would take more of their time than they could give; but when the time was up it was found that not one essay had been handed in, and we were all disappointed and curious to know what was the cause. Was it because there are no boys or girls of that age attending school, or was it because they are not interested, or was it because they do not read any papers? It was written up in the Oregonian, with cut showing the details of the medal, as also in all the horticultural papers and all the county papers in my district. In consequence of failure I extended the time to October 15 and widened the scope, inviting all boys and girls between the stated ages attending any country school, graded or ungraded, and whether located in a town, village or on a crossroad, and notwithstanding all this I received only five papers, four from girls and one from a boy, and the judges awarded the medal to Miss Hattie George, of Middleton, Washington county. (A copy of the essay will be found in the appendix). Many reasons for failure were given by the country press, but the one of the Rural Northwest seems to be the most correct solution. It says: "It is a peculiar and unpleasant fact that only five essays were received by Commissioner Dosch to compete for the handsome gold medal offered by him for the best article on horticulture written by a pupil in the common schools of his district. This re-enforces the statements which have been made as to the needs of instruction in horticulture in the public schools. It is evident that horticulture is a subject in which the pupils of the country schools feel no interest at the present time. Oregon will never become a successful fruit-growing state until this is changed."

Hon. J. H. Wilson, of West Virginia, said recently: "If I had the money I could see no better way of advancing the interests of the town I live in than by establishing an industrial

school. Instead of mechanics, we have persons in every trade that are not fitted for any special class of work. Instead of system and ability, we have the opposite. The common school system gives knowledge of a certain class that cannot be used to advantage toward securing a living. It fits a few teachers, a few clerks, a partial foundation for the majority, and by that majority not used until forgotten, and the loss of a certain number of years is the result. What is needed is an education that will fit the majority to secure a good living; to perform their labor in an efficient manner; to do work that will not only pass, but will be commendable. It is a usual rule to send a good mechanic out with a number of poor workmen, persons who have not learned the trade or are capable of learning it. The consequence is poor work and dissatisfaction. A poor mechanic will take longer to do the work, besides doing inferior work, and often entirely ruining it. What we want is concentration, the best work in the least possible time, and only thorough training with competent persons will secure this. Competition is so close that it is absolutely necessary this result be reached."

This applies equally to horticultural pursuits, but it is not the work of individuals, but a paramount duty of each state to furnish an education that will fit the majority to secure a good living, and as Oregon is an agricultural and horticultural state, and the majority of its inhabitants farmers and fruit-growers, we need instruction in our common schools which will educate in that direction. A notable instance, to illustrate, has recently been brought out by the Oregonian. It said: "An argument for textile schools is found in the growth of German woolen manufactures. Germany's sheep decreased between 1860 and 1890 from 28,000,000 to 13,500,000, but its number of woolen and worsted spindles increased in the same time from 1,699,759 to 2,600,000. When the English sent an expert commission over to learn the cause of German ascendancy in textile manufacture, the conclusion arrived at was that textile schools accounted for it." When a great country like Germany finds it profitable and necessary to establish schools for special purposes, and another great country like England finds it necessary to appoint a commission to inquire into this state of affairs, it seems to me that we could readily profit by it, and petition the governor and legislature to see that agricultural and horticultural education will form part of our public school curriculum.

FRUIT EVAPORATION.

At every horticultural meeting which I have attended this point comes up for discussion, showing it to be a very important one, both as to the mode of evaporating and the proper length of time to secure the best results. As it is known that I have experimented some along this line, I am usually called upon for my opinions, and will reiterate them here for the benefit of others. The question as to the amount of heat necessary, and whether to begin at a high heat and finish at a low heat, or *vice versa*, is pretty well settled, and all those who are known to make excellent fruits begin with the low heat and finish with a high heat, ranging from 140 to 180 degrees at finish, according to the fruit in course of evaporation, which not alone makes better fruit but prevents dripping, or, in other words, conserves the aromatic juices and fruit meats. But permit me to particularize.

FRENCH PRUNES.

In order to make a test I took three trays, filled each with 28 pounds of fresh fruit of equal size and ripeness, with the following results:—

First tray—Twenty-eight pounds; 10 hours; produced 10½ pounds; very bright, but tart.

Second tray—Twenty-eight pounds; 24 hours; produced 11¼ pounds; quite sweet and bright.

Third tray—Twenty-eight pounds; 36 hours; produced 10¼ pounds; dark, but very sweet.

This proved to me that 24 hours is a very happy medium for weight and sweetness. In dry seasons the evaporated product will be heavier, being more meaty. Italian prunes took 36 hours to produce similar results; these fruits were subjected to a heat of 180 degrees, allowing the trays to cool off during the night; neither of these prunes were dipped in lye solution.

BARTLETT PEARS.

One hundred pounds of fresh fruit, with skin, core and stem left on, cut in halves, produced 19 5-100 pounds of dried product. One hundred pounds of peeled fruit, not cored, only halved, produced 13 7-10 pounds of dried product. If pears are cored they lose too much flavor, while the peeled product is finer in appearance and is considered by some as fancy fruit; the pears with skin, core and stem are certainly

the best flavored. The peeled fruit will evaporate in 24 hours, while the unpeeled requires from 48 hours for the small ones to 4 days for larger ones, using 160 to 170 degrees and allowing to cool off nights.

APPLES.

I evaporated a large lot of various kinds, mixed, peeled, cored and ringed, and found that 100 pounds of fresh fruit produced 14¼ pounds of evaporated product; they evaporate in 4 to 6 hours, with a heat of 160 degrees.

FRUIT COMPETITION.

While we had but little fruit to evaporate this year, yet we anticipate a good year coming, and, as we must prepare for war in the time of peace, with a long winter before us for reflection and contemplation, it may not be amiss to consider the possibilities of improving our evaporated fruit products, to meet foreign competition at home and abroad, as well as the demand for better fruits. Through the courtesy of R. Koehler, Esq., manager of the Southern Pacific lines in Oregon, I received several bound volumes on prune evaporation as carried on at this time in Germany and France. After careful perusal it leads me to the belief that this industry is receiving a great deal more attention abroad than we are apt to give it credit for, especially in the production of extra fine fruits, with which to recapture the partially lost trade of America, and to prevent the sale of our own products, which have found a sympathetic market abroad, particularly in Berlin, where they are sold for 1 mark (24 cents) per pound.

Inquiry and observation leads me to the conclusion that our well-to-do and rich people here, as well as east, are not consumers of evaporated fruits as now produced by us, and it is only the laboring classes who are purchasers and consumers of it, and as they cannot afford to pay a high price for fruit we shall have to cater to this trade. Now, in order to capture all consumers, we must produce the best possible fruits for the lowest possible price, and the better the fruit the larger the consumption. With these facts in view, the people abroad set about experimenting in different ways with various results, until the Hon. E. Hoesch-Durren conceived the idea of "steaming" fruits prior to evaporation and has succeeded in producing a most excellent article. Now, as our fresh fruits in Oregon ore superior to theirs, we can still keep in the lead if we will only take a little more pains in producing the evapo-

rated article. The object of steaming the fresh fruit is manifold. It will open the pores of the skin to facilitate evaporation and prevent dripping, or, as Mr. Hoesch-Durren says, to prevent the loss of the aromatic juices and fruit meats and obviate the necessity of dipping in lye solution; it makes the skin tender and eliminates that leathery substance found in most of our dried French prunes; it hastens evaporation; it requires less heat and fruit will dry heavier or more meaty than unsteamed fruits. This alone is a strong recommendation and is worth all the trouble and expense. After various experiments as to the proper time, he found that steamed prunes can be evaporated in 8 to 10 hours, with high heat, but did not make the desired article, but concludes that 16 to 20 hours, with moderate heat (140 degrees) and rapid circulation, will produce as fine fruit as can possibly be produced. Where labor is cheap, he says, prunes can be readily peeled and pitted after steaming, which, when evaporated, make a confection called "prunelle," which is packed in small boxes, similar to our figs, and sold at fancy prices. The principal districts where those prunelles are produced are the departments of Lot and Garonne, in France, the prunes used being the Robe de Sergeant and Petite d'Agen. The output amounts to 10,000,000 francs annually. One peculiar feature in the production of this fancy fruit is that the trays are taken out of the evaporator once or twice and the prunes allowed to cool. This, it is claimed, adds to the weight and they will retain their aromatic flavor better than if allowed to remain in a continuous heat. When evaporating I always allow my fires to go out at night, thus reducing the heat to 70 degrees, and I find my fruits are always fine, heavy, aromatic, glossy, as if dipped in glucose, and are alive, that is, when put into bins, they crawl, as it were.

He describes the steam apparatus as a tight box, which holds from 4 to 12 trays, one over the other. The steam is introduced at the bottom and is allowed to escape at the top, through a pipe, gauged at all times so that but a slight steam pressure, one eighth of a pound, exists within the box. Prunes are subjected to from 10 to 15 minutes; pears, 15 to 20 minutes, and apples one and one half to two minutes. Pears and apples need not be bleached with sulphur, to which so many consumers object; but not only does steaming leave them in their natural pure color, but they become beautifully transparent. The fruits must be transferred quickly from

the steam apparatus to the evaporator. It is further claimed that cabbage, peas and beans, steamed and evaporated in this way, retain all their natural flavor, which is a point to be considered by our cannerymen.

As nothing is wasted in those countries of thrift and economy, they have found a way to conserve for use prunes which were bursted by rains, as occasionally happens in Oregon, all prunes too small for drying, as well as apples, pears, cherries, peaches, apricots, etc., not salable in their fresh state. This will, no doubt, be of interest and value to our fruit-growers, hence, permit me to quote a condensed description as given by Prof. Rudolf Goethe, of Geisenheim on the Rhine: "The fruits, after being washed, are placed in a copper-lined kettle and boiled soft (pears and apples being first quartered, skins left on), then passed through a sieve, which leaves the pits, seeds, cores and skins of whatever kind of fruit is being prepared. The jam thus produced is again put into the kettle and boiled down, sugar being then added to all tart fruits. Great care must be taken to prevent scorching by constant stirring with a wooden spoon or paddle, using the confectioner's mode of stirring in the shape of the figure '8.' When of proper consistency (which is ascertained by placing a spoonful on a plate, and if no juices separate it is right), it is poured — if done in large quantities — on wire trays on which waxed paper has been placed to hold the jam, and put into an evaporator and dried under a slow heat. If for family use, the jam is put on soup plates and dried in an oven, turning over occasionally, also under moderate heat. When nearly finished, so they can be handled, these cakes are taken out and placed on clean boards, and exposed to the air, which will make them firm and hard. They are then cut into strips to suit and packed away in boxes lined with wax paper, either for market or home consumption. These cakes will keep for many years without deteriorating, and are particularly valuable for military posts and expeditions, ships' and steamers' use, camping parties, farmers, and in climates where ordinary jams and jellies will not keep, and are especially appreciated in years when fruits are scarce and high. To prepare them for table use, take a given quantity of the cake, add sufficient hot water and allow to dissolve for one hour, then put on the stove and let it come to a boil; add spices to suit the taste, and you have a delicious, refreshing dessert, enjoyed by old and young."

EXPERIMENT STATIONS VERSUS STATE BOARDS.

Some interested persons are continually harping on the superfluousness of state boards, claiming that the work done by these boards should be done by the experiment stations and its professors; in reply to them permit me to quote from the Experiment Station Record, volume VII, number 6, of recent date, published by the United States department of agriculture and edited by A. G. True, Ph.D., director.

After speaking editorially of the value of experiment stations to the agriculturist and horticulturist, and pointing out the errors in which some stations have fallen into, concludes: "The experiment station was established to make experiments. The closer it sticks to its trade the greater will be its success in the long run. It does well to refuse to do a great many things which might help agriculture and horticulture. The education of the farmer requires other agencies. Police duties relating to the protection of his interest against fraud or loss may wisely be committed to state boards organized for the purpose. If the experiment station will thoroughly bring to him such aid as experimental science with its ever-widening range of operations can afford, it will perform the highest kind of service, and in the sequel will obtain the best reward in the confidence and esteem of intelligent, practical men.

"The introductory clause of the Hatch act has apparently mislead many people more or less intimately associated with the experiment stations. The stations are undoubtedly 'to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture and horticulture,' but this information is to be obtained by conducting original researches and verifying experiments, and the money from the national treasury is given solely 'for the purpose of paying the necessary expenses of conducting investigations and experiments, and printing and distributing the results.' It is very clear that this act did not contemplate that the stations would be general agents for the promotion of agriculture. Their operations were not to interfere in any way with the work of state boards or commissions of agriculture. A large, distinct and important field of work was plainly marked out for the stations in the organic act, and it will be well for the agriculture of the United States if they are kept within these limits."

ORCHARD QUARANTINE.

In one of my quarterly reports I said: "We have now given seven years of our best thoughts and careful study along the line of horticulture, in all its various phases and branches. We have done a good deal of patient, painstaking, educational work in the field, and all fruit-growers should now be fully conversant with and know how to care for their orchards and fruits." I further said: "We have been very lenient in the execution of the law, but the time has arrived when we must call a halt. It is due to the progressive fruit-grower and the state at large." Unfortunately, however, the hardest time Oregon ever saw, and it is to be hoped will ever see again, set in, and when I ordered old orchards cleaned up I was told by the owners, who generally are old pioneers, that they did not have the money to buy pump and material with which to spray, much as they would like to, and when I told them I had been severely censured in one quarter for not enforcing the law, one of them said, who is now 80 years old: "Well, I and my wife are too old to prune or grub it up, and have no money to hire it done, and really do think we ought to be treated with leniency, and it seems to me that we old pioneers are entitled to some consideration from this generation for what we have done for Oregon, and made it possible for them to exist"; but the other side informed me that I had no right to take these conditions into consideration, and that we were not a philanthropic institution; that our board was created to protect the fruit interest; all of which we are painfully cognizant. But there are times in the life of commonwealths when it is not only charitable, but it seems to me a duty we owe to each other, to be lenient in the enforcement of laws and temper justice with mercy. Had I placed such orchards under quarantine as demanded and the work of cleaning up done by the county, the expense would have become a lien on the property, and these people could not have paid it, but would have been sold out and set upon the highway to begin life over again. J. C. Hare said: "We need not be afraid that we shall go too far in serving others. There is no danger that any of us will ever go too far in the walk of active love. There is no likelihood that any of us will become too bountiful, too kind, too helpful to his neighbor." When our present law was under discussion, the governor, with his usual foresight, said: "A law giving such powers as stated in sections 7 and 8, placed in the hands of a vindictive person,

would create untold trouble and hardship on many people," and seriously considered for one week to veto the bill on account of these powers given. In consequence, the committee added section 9, which reads: "The powers conferred in the two preceding sections of this act shall be exercised only in great and imminent danger to the fruit interests of the state, and with the utmost caution and regard for the rights of individuals affected, consistent with the safety and welfare of the fruit interests of the whole state." I am well aware that the progressive orchardist has rights which we are in duty bound to consider, and predict that in another year, with good times in store for us and renumerative prices for fruits, will see every old orchard renovated or make room for new plantations; if this cannot be accomplished by peaceful measures, then the law must take its course. However, many old orchards have been pruned, renovated and sprayed as directed, and others dug up bodily and burned, through education and moral suasion, assertions to the contrary notwithstanding.

Respectfully submitted,

Henry E. Dosch

Commissioner, first district.

SEVENTH QUARTERLY REPORT.

"The expectations of life depend upon diligence; and the mechanic that would perfect his work must first sharpen his tools."—CONFUCIUS.

HILLSDALE, October 11, 1897.

To the president and members of the state board of horticulture:

Herewith I have the honor to present to you my semiannual report. Since our meeting in April, I received 493 letters from fruit-growers, in our own as well as neighboring states, upon all manner of horticultural questions. As usual, it afforded me great pleasure to answer them, full and complete. I attended the annual meeting of the state horticultural society at Portland in January, and the semiannual meeting held at Newberg in June, and upon invitation read

papers pertinent to our horticultural interests, notably on prune evaporation. Also visited the markets, fruit-dealers and commission houses of Portland regularly for the inspection of fruits, being obliged to condemn several scale-infested lots of pears and apples.

I am pleased to report that from my observations I find that a number of our insect and bird friends have made great inroads on some of our insect pests, notably on the wooly and green aphis. I found that the larvæ of the syrphus fly have been feeding heavily on wooly aphis all season; also the *Podabrus comes*, a little beetle, I reported upon two years ago, has spread over a large territory, and has destroyed whole colonies of green aphis. Our little friend, *pentilla missella*, the black, glossy, coccinella beetle, which I discovered last year, has developed new and gratifying feeding propensities, for I found that after clearing out all the San Jose scale on certain trees under observation, they attacked and devoured all the oyster-shell bark lice on these same trees, but regret very much to state that they have not increased as hoped for. Another friend of the fruit-grower has developed in one of the German song birds, imported some years ago, the "Zeisig," *Fringilla Spinus* misnamed Green Finch (the latter being an entirely different bird), a small, dark green and very active little warbler, which is most destructive to the entire aphide family, especially during breeding time, when the male is obliged to gather food for his better half while incubating, which, like all good mothers, stays at home to attend to the rearing of their offspring, and afterwards to the hungry youngsters themselves. I have watched and seen them clean old wooly aphis-infested apple trees in a very short time. While on this subject, permit me to call attention to another insectiverous bird which has been spoken of recently and is highly prized in Germany, as it lives mainly on the larvæ of insects, notably the much-dreaded and destructive codlin moth and is known as "Kohl Meysen" (*Purus major*), as well as the "Blau Meysen" (*Parus coerullus*), the latter being plentiful along the Rhine in Germany, feeding on the eggs and larvæ of insects. This bird does not migrate in the winter, but spends its time searching trees, fences, etc., for eggs of insects, and especially the larvæ of the codlin moth. It is a small, very active bird, and to the fact that it is found in great numbers there is attribu-

table the further fact that there are few wormy apples in that country.

While a few patriotic men have contributed to import some of our fine song birds from Germany, and the "woods are now full of them," it appears to me that this is a duty of our state and not individuals. Other states, like California, for instance, have spent thousands of dollars for the importation of parasites from Australia and elsewhere, for the destruction of the various scale and other injurious insects; why not our state import a few hundred pairs of these valuable birds to assist this immense and growing industry of fruit-growing, and as these birds are not migratory, like the others, we have them, like the poor, always with us and can be depended upon to be on hand when needed.

We have learned from sad experience that while a few progressive fruit-growers will spray their trees, the majority of small growers will do nothing whatever, and allow their fruit trees to become pasture and breeding places for vermin for their up-to-date neighbors. We have done a good deal of educational work along that line. Even those who are opposed to this board admit this. And yet in view of all this, I feel discouraged, and, as I said some time ago, "horticultural education has reached debatable ground." Please note the loss of so many prunes this year from brown rot, *Monilla fructigena*, a fungus disease; a loss of from 30 to 50 per cent. is reported from Corvallis, the very seat of agricultural education. Allow me to quote a letter just received:—

"*Henry E. Dosch, Esq., Hillsdale Oregon*—

"DEAR SIR: We are having a great many reports come to us that Italian prunes have rotted in transit, arriving at the other end of the line in bad condition. This is not the cause of the low market wholly, as that was undoubtedly caused by over-supply in the hands of irresponsible parties, without facilities for protecting the shippers' interests. This question of rottage in Italian prunes is, nevertheless, a very serious one, as it entirely upsets our previous experience, which showed that the Italian prune was a remarkable keeper, even when somewhat rain damaged.

"Knowing that you are interested in horticulture, and desiring to get all facts concerning the keeping qualities of Italian prunes, so that we may be better able to handle them

in the future, we take the liberty of encroaching upon your time, and ask you to kindly write us a letter on this subject.

"Yours very truly,

"EARL FRUIT COMPANY."

In reply I said: "The Italian prune as a shipper is first class, but the cause of these prunes rotting even after they are ripe, is a fungous disease (*Monilla fructigena*), which starts from within, and there is no good reason for its existence. It is simply the result of carelessness and neglect, and the prune-grower has no one to blame but himself. This disease made its first appearance some six years ago, confining its ravages to the tender Pond (Hungarian) prune. Seeing danger ahead, I sounded the alarm, both at horticultural meetings and through the press. However, no notice was taken of it. A few years later it began to attack our fine Italian and French prunes. I again waved the red flag of danger, but for some unaccountable reason, only a few progressive orchardists sprayed their trees as directed, with complete success."

When I compiled our report of 1895 and 1897, as well as bulletin No. 9, I took particular pains to impress upon orchardists the necessity of spraying all fruit trees thereafter in the fall of the year, for the various fungous diseases. Had these advices been heeded, no losses would have resulted.

Our humid climate is especially inviting for fungus growth, and this year, owing to our peculiar climatic conditions, this disease has spread with appalling rapidity. The enemy is here in full force, and unless our prune-growers desire this large and expanding industry totally destroyed, they must marshal their forces at once and fight him all along the line. No unconditional surrender is to be accepted; nothing but total and complete annihilation will do in this case. Brother horticulturists, call a halt in your easy-go-lucky way, girdle on your armor, mount your spray pumps, filled with bordeaux mixture, and attack him with all the force and energy the case demands, and your efforts will surely be rewarded. The danger is great and, I earnestly beseech you, do not let your hands be idle. Nature has done very much for us in Oregon, but we must not expect too much. "God helps him who helps himself."

When this disease, as well as shot-hole fungus and curl-leaf, made its appearance in my prune orchard, we attacked all at once with lime and blue vitriol, and are masters of the situation, none of the three being visible now. The time for the

first spraying is close at hand, or as soon as most of the leaves have fallen, with a solution of 10 pounds of lime, 6 pounds of blue vitriol and 40 gallons of water, properly dissolved and mixed. The trees should be covered from the ground to their topmost branches; again with full strength bordeaux mixture just as the buds are swelling; and again with modified bordeaux mixture when the prunes have attained the size of hazelnuts. If, however, the disease should make its appearance—which I very much doubt if the previous sprayings have been done properly—when the fruit is about to mature, they should be sprayed with 1 pound of copper sulphates to 200 gallons of water. It will also be found that if the spraying is done thoroughly the first year, less spraying will answer in after years.

Please remember that the treatment with fungicides is preventive, not remedial; and it should also be remembered that we cannot always wait for clear weather to spray. Cloudy weather or the appearance of rain should not hinder the work. Properly prepared mixtures kill by contact, and will stick to the limb, foliage and fruit even through hard rainstorms, provided they have half an hour in which to dry. In fact, nothing short of an actual rainstorm should stop the work when the time comes that it should be done.

Professor Goff, of the Wisconsin experiment station, says in this connection: "It should be emphasized that in fungus diseases the parasitic plants that cause the injury develop wholly or in part within the tissue of the plants that they infest. As we can apply no beneficial treatment to the interior of a plant or fruit, we can do little toward curing a fungus disease that is once established upon its host. Our chief hope lies in preventing the germination of the injurious fungus and thus excluding the disease. From this it is clear that the treatment must not be delayed until the plant or fruit testifies by its withered or blasted appearance that the dreaded disease is already sapping its life. The preventive application must be made before the spores have had time to germinate, and must be repeated as often as necessary, until the danger of infection is past. The observance of this rule is absolutely essential to success in many of our most serious plant diseases.

The Oregonian recently said editorially regarding our educational work and the loss of prunes by rotting, under the heading of "Prunes and Book Learning": "The very

general inclination of students to advise the workman as to his work, and the equally general disinclination of the workman to receive that advice kindly, form one of the many interesting problems that await the coming philosopher. This advice is not always offered in the most judicious spirit, and sometimes it may be altogether wrong. But, as a rule, the student knows what he is talking about, and when his advice is disregarded the workman pays for his refusal to improve his condition by the investigations of experience and research. The loss is his, and usually it is serious and irreparable. Here in Oregon we all know how book learning and newspaper farming have been sneered at and put aside by the intensely practical," etc.

While the advice given by myself and confreres was offered in the kindliest spirit and from most unselfish motives, based upon scientific research, practical experience and best results obtained therefrom, truer words were never spoken.

Carlyle says: "Experience does take dreadful high school wages, but he teaches like no other."

Our fruit-growers may as well make up their minds to the fact that they must either keep the spray pump going at proper seasons, or else take the consequences of partial or total loss of their fruit harvest.

In conclusion, permit me to add that the Italian prune is all right if properly handled and cared for; and nowhere on earth does this delicious fruit grow to such perfection as in Oregon.

Respectfully submitted,

Henry E. Dosch

Commissioner, first district.

EIGHTH QUARTERLY REPORT.

"The world moves along, not merely by the gigantic shoves of its hero-workers, but by the aggregate tiny pushes of any honest worker whatever; all men may give some tiny push or other, and feel that they are doing something for mankind."—JOHN RICHARD GREEN.

HILLSDALE, January 10, 1898.

To the president and members of the state board of horticulture:

Permit me to present to you herewith my seventh quarterly report.

No field work has been done during the winter, except through correspondence, having received the usual amount of letters, most of which were about winter sprays, showing that our fruit-growers begin to realize the necessity of spraying while the trees are dormant, especially against San Jose scale and fungous diseases.

I have inspected all the nurseries in my district, some 33 in number, and with the exception of 4, they were in very good order. Most nurserymen begin to learn that the inspector's certificate does not help him to sell his wares, but in order to hold his trade he must keep clean and healthy stock, which is only a plain, commercial law.

Judging from the many visitors I entertained, and who came to examine my evaporator and incidentally learn the true principles involved in preparing palatable, merchantable fruits, proves that more interest is manifested in that direction than ever before, and many up-to-date evaporators will be built this season.

It may be deemed rash by the casual observer to predict, in the face of the losses sustained the past season by many of our fruit-growers, a fair outlook for horticulture the present year; nevertheless, such seems to be the case at the present writing, and while we do not and cannot look for a boom, we certainly have reason to hope for remunerative figures for all of our fruits.

The wave of prosperity which is rolling, slowly but surely, from east to west—in fact the advance riplets have already reached the shores of the Pacific—has sent the blood coursing rapidly through the veins of many a slow-moving fruit-grower, filled him with renewed energy and swelled his heart with the good cheer the year 1898 is sure to have in store for him,

which is evidenced by the pruning, spraying and general renovation of partly neglected orchards.

Upon examination I find that fruit buds have set well, the season having been most propitious for this purpose; the trees are in a fairly dormant condition, and with the present cool weather promise nothing but good results. True, fruits are selling very low just now, being caused by California rushing in their inferior, sun-dried, small-sized goods in anticipation of the Alaska demand, the sale of which is rather to be encouraged than otherwise, as it will clear the market of the accumulated trash of years—always a menace—and leave us a clear field for both eastern and Alaska trade. The era of high prices has passed, nor do we desire its return, as it checks consumption, and, as said, that while we do not and cannot expect a boom, we may reasonably look forward to a healthy condition of the market and for remunerative prices. I may, therefore, say in all seriousness that the outlook in horticulture for the year 1898 is bright and promising.

Respectfully submitted,

Henry E. Dosch

Commissioner, first district.

NINTH QUARTERLY REPORT.

All that is best in us struggles for expression, because it does not belong to us alone. No gift, no talent or faculty is merely private property.—CHARLES G. AMES.

HILLSDALE, April 12, 1898.

To the president and members of the state board of horticulture:

Kindly permit me to present to you my semiannual report. Since our last meeting in October I have received many letters—some 400 or over—from many of our fruit-growers, most of which are on the subject of pruning and spraying, showing that at last the educational work done by this board for so many years is beginning to bear fruit. Several trips through the fruit districts, I have recently taken, revealed the effects of the spray pump in many orchards, notably the younger plantings, which are in the hands of progressive

orchardists, being mostly prune orchards, to check the brown rot (*Monilla fructigena*), a fungous disease I called repeated attention to for the past four years, which awaited only favorable climatic conditions to fully develop, as it did last year, destroying so many of our fine Italian prunes.

Again, many of these letters came from the farmers of the middle west, who were inquiring about orchards and orchard lands, being tired, as many stated, of the hot summers and cold winters, fighting for their very existence, and are now seeking our climate, where the conditions of life are not equaled anywhere on earth, which is very gratifying, as their attention was called to it through the horticultural reports issued by this board. It is hardly neeessary to say that all these communications received prompt attention, and were answered in the fullest detail.

I have attended all the horticultural meetings in my district, also the Fruit-growers' association's annual meeting of British Columbia, whither I had been invited, and read three papers on horticultural subjects during its session, being elected an honorary member, the provincial government doing me the honor to have these papers printed in pamphlet form for general distribution. By invitation from the faculty I delivered a lecture on "Horticulture and its Problems" to the students of the farmers' short course at the agricultural college at Corvallis. I also had the management of the Northwestern fruit-growers' convention, comprising the states of Oregon, Washington, Idaho and British Columbia, which held its annual meeting in Portland during January, and, as you know, proved a most interesting and successful meeting. During that meeting, while discussing the codlin moth, it was conclusively shown that the moth does not deposit its egg in the calyx or blossom end, but on the leaves close to, and sometimes on the fruit itself. When the egg hatches, the larvæ slowly finds its way to the calyx, and begins its deadly work. During my visit to the British Columbia meeting in January, some very handsome apples were shown. I also examined numerous boxes of apples in store, but failed to find a single worm, these apples being grown near the coast. After studying this matter thoroughly, I reached the conclusion that the salt-laden air and fogs settling on the leaves prevented the egg from hatching, or rather destroyed their vitality. We know that all our apples grown in our own coast counties are also free from worms.

The experiment which I am making with the fungus

(Sphærostible coccopita, Tul) discovered by Prof. T. H. Rolfs, of the Florida experiment station, for the destruction of the San Jose scale, has not yet sufficiently developed to prove successful. The little coccinella beetle, *(Pentilla missela)* which I discovered a year or so ago and reported upon at the time, and the special enemy of all scale insects, has thriven finely during our mild winter, and I was much gratified to find several colonies working on San Jose scale and oyster-shell bark lice, infesting wild crabapple trees in our woods.

Some two years ago the twig-borer made its appearance in the prune orchards in the vicinity of Newberg, and has spread to some extent since. As a remedy, I advised the spraying of all orchard trees in the fall with sulphur, lime and salt solution, followed up in the spring as soon as the buds begin to swell, with the following wash or spray:—

Ingredients—Sulphate of copper, 3 pounds.
Lime, 4 pounds.
Paris green, 4 ounces.
Water, 45 gallons.

The orchardists, who were progressive enough to follow these instructions, have met with gratifying results.

For some weeks past, however, I have been flooded with letters and twigs seemingly damaged by this same borer, but on close examination I became convinced that another enemy had been imported and was doing deadly work. As usual, I applied to Prof. A. B. Cordley, our eminent entomologist at the Corvallis experiment station, who, like all of its professors, is ever ready to furnish cheerfully any information desired, and he writes to me as follows:—

"Your letter is at hand. I, too, have had numerous letters and samples of the so-called twig-borer. As a matter of fact, however, the insect that has been attracting so much attention this spring is not the twig-borer, but the 'budmoth,' an insect that, so far as I know, has never been reported in Oregon before, though, of course, it must have been present in the state in small numbers for several years. At the rate it has increased this year, it will certainly be a most serious pest another spring, unless some means are taken to check it.

"The chief injury by the spring brood has already been done, but now the moths have commenced to issue that will soon commence to lay eggs for the next brood. These eggs will be laid on the leaves of various trees, and the young larvæ will feed upon the leaves throughout the summer. In

the fall they will retreat upon the branches, secrete themselves in crevices about the bud scales, or even bore into the bark, and inclose themselves in inconspicuous cocoons, in which they will pass the winter. Next spring, when the buds begin to open, these half-grown, hungry larvæ will leave the cocoons, and attacking both the leaf and flower buds, will undoubtedly do much damage.

"Of course, this is only a prophecy, but even a prophecy based upon the extraordinary rapid increase of the insect this season, and upon the further fact that it does not seem to be controlled to any great extent as yet by parasites. The right time to apply a remedy is just before the buds open in the spring. But I am also inclined to believe that any orchard that is already attacked may be effectively protected against future injury by spraying it with paris green between now and June 1, the idea being to have the poison upon the leaves when the eggs hatch, so that the larvæ's first meal will be a poisonous one. It would also be well at the time of applying the first spraying with bordeaux mixture next spring to add paris green to the mixture.

"The work of the June brood of the 'budmoth' must not be confused with the work of the true twig-borer, which will undoubtedly again attack our prune and peach trees, as it did last June. The twig-borer will kill the tip of the young shoots in June, much as the summer attack by the budmoth has already done, while the summer attack of the budmoth, which will begin in June, will be confined very largely to the leaves. The injury done by the budmoth may be largely prevented, as I have said, by paris green spray."

The outlook for a prosperous fruit year at this writing was never better. Commercially, the few sharp frosts have done no damage, except to a few apricots, early peaches and some tender varieties of almonds not suited to our climate; late peaches and hardy almonds, though in full bloom, show no signs of injury. Our commercial fruits are just going into bloom with every prospect of an abundant harvest.

The low figures obtained for our fruits, both fresh and evaporated, in the eastern markets, arising from a singular combination of unfortunate causes, not likely to occur again, cannot be figured entirely as a dead loss, for it has been of an educational nature, and has induced many a family of small means to use our fruits heretofore unacquainted with them. The losses sustained must therefore be charged to the advertisement account, necessary in every business. As a result,

we see now in the fruit stores of the great eastern cities placards "Oregon fruits," for the first time in the history of Oregon horticulture, which in itself proves it a good investment for the future. We also know that people who have once used Oregon-grown fruits will have them again, even at a higher price, provided our fruits are put up honestly and in merchantable packages, so the contents are just what the outside represents them to be, for consumers are beginning to discriminate between good and bad, true and false.

Perhaps it may be in order here to state just what caused the losses sustained last fall by the shippers of fresh Bartlett pears. I had an unusually fine lot of Bartlett pears, and instead of evaporating them as heretofore, and lured by the high prices obtained by the California valley shippers, concluded to ship them fresh. Unfortunately, they reached eastern markets when prices had gone down, and were sold at $1.25 per box, but as the expenses connected with the shipment amounted to $1.31 per box (the freight and refrigeration alone being $1.00 per box), I came out loser.

The main factor which caused the slump in prices is this: Usually when our Bartlett pears come into market, those of the valley orchards of California are well out of the way and ours are followed by the eastern-grown pears. The pears of the California hill orchards, which come into market about the same time with our own, are generally contracted to the canneries, but owing to the high figure obtained by the valley growers ($2.25 per box) caused these growers to abrogate their contracts and ship them east. The prevailing hot weather east at that time brought their pears into market three weeks ahead of the usual time, and all these tremendous shipments from three sections were thrown upon the market together, hence the slump.

The shipments of fresh prunes fared even much worse. While all that applies to pear shipments is true also to prune shipments, there were other factors which added to the losses, the principal one of which is, perhaps, that our fresh prunes were not sufficiently known to dealers and consumers, hence the demand was rather limited to absorb the extra large quantities shipped; while a good many shipments arrived east in bad order, I know of at least several shipments where the prunes had been picked carefully with stems and bloom left on, properly packed, and arrived east in first-class condition, and yet brought only 25 cents per crate, costing 60 cents to lay there. Our prunes also came into direct competition with a heavy

crop of plums, which also ripened much earlier east than usual, and with which dealers and consumers were familiar.

It will thus be seen that owing to the peculiar existing conditions, fresh fruit shipments were not profitable as a whole, though the earlier and later shipments of prunes at least brought paying figures.

While at the agricultural college at Corvallis a few days ago, for the purpose of securing an educational exhibit for the Omaha exposition, so our eastern farmer friends who may desire to emigrate hither can learn and know that we are just as far advanced and abreast of the times as our middle and eastern states, and that their children will have the opportunity of enjoying the best of educational advantages in this wild and woolly west, I had the pleasure of witnessing the beautiful ceremonies of Arbor day and the planting of several class trees. The orator of the 1898 class, during his excellent remarks, asked the question, "What does the planting of these trees teach to us?" to which he might have added, "When was the first Arbor day?" Both are serious and pertinent questions. The first Arbor day was unquestionably before the era of man, for history tells us that when the first couple was placed upon this earth there were trees laden with tempting and beautiful fruit as well as trees for ornament; there were also trees whose roots grew into the domain of other trees, robbing them of part of their sustenance, their branches, gnarled and crooked, reaching into those of their neighbors, destroying their beauty and symmetry, and again, others clinging and entwining their limbs in loving caresses about others, only to destroy them; while, on the other hand, such trees as the lordly pine, the royal walnut, the majestic oak and the great American elm, whose roots struck down deep and firm into the soil, with branches reaching up, up towards heaven, held their heads proudly aloof and above their inferior surroundings, undisturbed by their cringing, crooked neighbors, and this brings us to the first question asked. There is a peculiar and significant parallel between these trees and the human family. We know of the ever-present mischief makers, meddling in everybody's affairs, sticking their noses and elbows where they are not wanted, as well as the crooked and corrupt, and even those who, with smiling eyes, sweet words upon their lips, lay their hands lovingly upon our shoulders and arms about our bodies, only to cause our ruin; while on the other side are those whose roots of industry, of honesty, of integrity, of stability, are firmly planted in the ground,

with heads erect, face turned to their creator, arms lifted up in earnest endeavor for all that is grand and good, their very frames filled with the noblest aspirations.

Young maidens and young men, you have the growing of the tree within yourselves; the picture is before you, which shall it be?

Respectfully submitted,

Henry E. Dosch

Commissioner, first district.

TENTH QUARTERLY REPORT.

"Nothing great was ever achieved without enthusiasm."
— EMERSON.

HILLSDALE, December 25, 1898.

To the president and members of the state board of horticulture:

Owing to my absence at Omaha, in charge of our exhibits at the trans-Mississippi and international exposition held there from June 1 to October 31, where I believe I have been enabled to do more for our horticultural interests than if I had been here, I was not able to be with you at our regular meeting, but submit this, my report, for your consideration.

Some 500 or more letters were received at my home and promptly forwarded to me. As usual, these letters came from all parts of the Pacific coast as well as other states and asked about all kinds of information on horticultural subjects. It is perhaps useless for me to say that they received my best attention.

Not having been in the field this summer, I cannot speak from personal observation as to the condition of our orchards, but from inquiry I learn that a more general cleaning up has been done than heretofore and the result is a much better quality of fruit, possibly the consequence of a prediction I made in my January report, heeded by up-to-date fruit-growers. I said: "It may be deemed rash, by the casual observer, to predict, in the face of the losses sustained the past season

by many of our fruit-growers, a fair outlook for horticulture the present year; nevertheless, such seems to be the case at the present writing, and while we do not and cannot look for a boom, we may reasonably look forward to a healthy condition of the market and for remunerative prices. I may therefore say, in all seriousness, that the outlook in horticulture for the year 1898 is bright and promising."

How far this prediction has been verified is best evidenced by the fact that all our evaporated prunes have been sold at good figures and it is doubtful if 5 carloads could be bought this day in the whole state; apples are selling in carload lots at $1 per box and most growers are holding for higher figures and undoubtedly will obtain them before spring.

Allow me to quote from a letter received from Mrs. Clara Parsons, formerly of Eugene, who had charge of our educational exhibit at Omaha and now on a visit to Chicago. The letter is dated Chicago, Illinois, December 19, 1898: "We indulged in the luxury of 'Oregon prunes' a few days ago, 15 cents a pound, and very poor quality for price, but were from Oregon for a' that. Box was from The Dalles." Comment seems unnecessary.

My observations gathered this summer at Omaha lead me to the belief that there is a vast field for our Oregon fruits in the middle west, judging from the astonishment expressed by the visitors to our fruit exhibit. Unfortunately, we received most unkind treatment from our fruit-growers, in whose interest this exhibit was made, who had been repeatedly appealed to, both before leaving here and after reaching Omaha, for samples of fresh and evaporated fruits, but very few responded. But what we did have astonished the natives. Many thought our Royal Anne cherries were crabapples, and our Black Republican and Bings were taken for plums; our apricots were as large as their peaches, and our apples, pears and berries were beyond comparison—they simply were the admiration of all beholders—and as a result we received in this department alone five gold medals, eleven silver medals, sixteen bronze medals and twenty-three "honorable mention," receiving an award for every exhibit made.

The thousands of people to whom we gave our fresh cherries, strawberries, prunes, apricots, peaches, pears and apples, and who went into ecstacies over their size and flavor, will not be satisfied hereafter with the insipid, small, sour fruits supplied to them heretofore, but will surely clamor for them again, and compel their dealers to supply them with Oregon

fruits. I have become thoroughly convinced that there is not alone a good market for our goods in the middle west, but that people must be shown the fruits we have for sale, so they can freely comprehend and believe. There is nothing so convincing as optical object lessons. In my opinion it is the only way to advertise our state properly.

It has always been with me an applied business proposition that if there is no market, create one by educating the consumer, and the dealer will readily respond, and there is no better field than the middle west. And again, there is the Orient, not alone our new acquisitions, but Japan offers a vast field for the promoter.

Hon. W. H. Seward, in a speech delivered in the United States senate as far back as 1852, said: "The Pacific ocean, its shores, its islands, and the vast regions beyond, will become the chief theatre of events in the world's great hereafter."

This hereafter is here right now, perhaps much sooner than this great statesman anticipated, but he did not know then that he was standing at the threshold of an electrical age, where events pass with lightning rapidity, and what is new today is old tomorrow. The new fields opened out to us offer an exceptional opportunity for the promoter, as stated before. Hon. D. P. Thompson said to me only a few days ago: "I just received some letters from Tokio, Japan, from friends to whom I had sent a few boxes of evaporated prunes for a present. They write me that nothing of the kind could be had there for love or money, and expressed a surprise that if we had plenty of such fine fruit, why we did not ship it there, as there was practically an unlimited market for it."

I am firmly convinced that in these districts alone is a field for operation that will absorb all the fruits raised in Oregon, and that there is a market, not alone for our fresh, canned and evaporated fruits, but for everything else we have for sale and can supply these markets with, which seems to be a very inviting field, and certainly worthy of investigation by our manufacturers and merchants. Let us look a little further. The New York Journal of Commerce of December 23, 1898, says:—

"A large increase in the shipment of Pacific coast apples abroad by the way of New York this year is a noteworthy feature of the fruit trade, and is exciting no little interest."

"Large quantities of Newton Pippins, in boxes weighing 50 pounds net, grown on the Pacific coast, principally in Oregon

and California, have been sent to this city of late, in carload lots, and from New York have been sent directly abroad, as are something like nine tenths of all the Newtons grown in this country. The following table will show the increase in the shipments of this year, compared with those of last. The statistics have been carried out only as far as December 15, but, as will be seen, the half month this year is much in advance of the whole month of December, 1897:—

Shipped during season.	*To London.*	*To Liverpool.*	*To Glasgow.*
	Boxes.	*Boxes.*	*Boxes.*
November, 1897	4,800	900	----------
November, 1898	23,800	20,300	2,500
December, 1897	10,800	8,500	2,000
December, 1898 (15 days)	12,200	18,100	3,400
Total	44,000	39,000	4,000

It will be observed that the exports this season have been decidedly larger compared with last season, which virtually was the first time these Oregon and California apples were sent abroad. This fruit is packed in boxes, each apple being wrapped in paper, and each box containing four layers of fruit. Further on, is said:—

"Some very handsome Newton Pippins passed through New York lately from Oregon." I presume these came from Eastern Oregon, as in that region the Newton Pippin reaches its highest perfection. Almost all of this fruit has gone on the steamers of the American line, which of late have had from 7,000 to 8,000 boxes per boat, and also the fast steamers of the Cunard and White Star lines, which have carried from 4,000 to 8,000 boxes per boat. Again is said:—

"It must be remembered that besides these apples in boxes the shipments to foreign ports of apples in barrels are heavy."

It will be noticed that the shipments to Glasgow are 4,000 boxes this season, which is unquestionably the outcome of a lot of apples shipped there in 1897, and about which the consul stationed there wrote to the shippers, under date December 7, 1897: "In a lot of apples received from Oregon and on sale in this city were found placards on which was printed 'Rogue river valley apples, from the orchard of C. Kleinhammer, Phœnix, Oregon,' saying finer fruit had never been exhibited in that market, and dealers wanted to secure the output for another year."

Thus another and unlimited market is opened for the wide-awake fruit-grower, showing that intelligent endeavor, honest packing, brains and the application of business principles, which hereafter must be adopted in order to be successful in horticultural pursuits, have their own reward.

My observations at the Columbian exposition at Chicago, and more recently at the trans-Mississippi and international exposition at Omaha, lead me to the conclusion that the apple is the commercial fruit par excellence of the whole world, as a fresh fruit, followed by our fine prunes, as an evaporated product.

A properly planted out apple orchard, considering the best marketable varieties, and all other essential elements entering into it to make it a success, yes, and even a prune orchard as a good second, offers today a better field for investment of money and brains than any other commercial enterprise, with the additional advantage of living close to nature, as our creator intended for us to live, with its outdoor, healthful, life-giving exercise and ideal existence.

Here I have pointed out three distinct and unlimited markets for our fruits; all we have to do is to reach out for them. We have the soil and climatic conditions to produce the finest of fruits, and the markets of the world, so to speak, are right at our doors. Beaconsfield said:—

"The great secret of success in life is to be ready when the opportunity comes."

Respectfully submitted,

Henry E. Dosch

Commisssoner, first district.

REPORT OF THE COMMISSIONER

SECOND DISTRICT.

To the honorable state board of horticulture—

GENTLEMEN: In the preparation of this, my first biennial report as commissioner of the second horticultural district of Oregon, I have encountered some difficulty in making it as complete in detail as I desire. Much of the most valuable work of a commissioner depends upon time, such as observations of the various diseases and pests as they occur in different parts of his district under different conditions. What may seem a serious matter one year often disappears the following season, and what deeply concerns those of one county or section often does no harm under different conditions in another locality. The "evening up of nature" process often cures seemingly very serious horticultural troubles, while other very mild diseases at the start prove to be very serious in the end, much as a cold in the human family may eventually end in consumption, which kills. Careful observation, therefore, in all parts of a district for some considerable time is much to be desired, in order to arrive at satisfactory conclusions. Since the last biennial report of this board was issued, under date of December, 1895, three changes have taken place relative to the commissioner of this district. The commission of Mr. R. D. Allen expired in January, 1895. Hon. John Minto was then appointed to fill the vacancy, and upon his resignation, I received the appointment and have served since. My commission bears date of October 14, 1895, and this report will therefore be confined to work performed by me since that time, together with such observations and suggestions as may seem best to mention. The second horticultural district comprises the counties of Marion, Polk, Benton, Lincoln, Linn and Lane, and contains within its boundaries probably more young orchards than any other like territory in the state, and is much in the lead as regards the growing of nursery stock. The first duty which devolved upon me was the inspection of nurseries, the result of which

I reported in my first semiannual report, and which I here incorporate as follows:—

At the October meeting of the state board of horticulture, the prominent discussion and attention given the then proposed inspection of nursery stock has become a reality in fact, and claimed most of my attention since, this being the proper season for such work. After the adjournment of the board I at once published, as required, the amended sections of our quarantine regulations in each county of my district. Also have had copies of the same posted in each county. Twenty-four nurserymen have applied to me for inspection of their nurseries up to this date. I at once responded, and in each case, after inspection, issued a certificate. I found perfect harmony among them relative to inspection of their stocks, and in no instance have I found a disposition to evade the law. Nurserymen realize that some action is necessary to govern the question of infested stock, and only ask that the best and most equitable means be adopted to meet this end. As the nurserymen's association drafted and presented to the board for consideration the present rules governing this matter, which were, with few exceptions, finally adopted, there seems to be a general satisfaction in their application.

Growers familiar with the subject know that many inferior trees have found their way into orchards during the past few years, while many thousands more have been planted which were infested with injurious insects or disease. In view of these facts, and the just wail of those who, after years of waiting and working, find their trees not true to name, or dying from diseases contracted in the nursery, it is very apparent that something should be done by striking at the root of the evil. It is not expected, nor is it possible to discover and stamp out every insect and pest which harbors on nursery stock, no more than it is possible to cure every ailment of the human family. But if by due diligence or inspection and the application of remedies we succeed in stamping out ninety-five per cent. of diseases and pests which have heretofore gone scott free, it seems to me we have accomplished a very great good to fruit-growers, and in an indirect way to the general public. It is not my understanding of the intent of the law, nor has it been my practice to use extreme measures, except in very serious and extreme cases, but rather to apply remedies where it is known they are effective, and, when such prescriptions have been applied, allow commercial transactions to proceed.

There is no doubt in my mind but a large percentage of the pests and diseases of our grown and growing orchards of today originated while the trees were young and in the nursery rows, where proper care was not taken of them. So perfectly is this matter now recognized and understood by our progressive nurserymen, that I find the following inserted in the catalogue of our representative nurseries (Oregon Wholesale Nursery Company, of Salem): "Fully realizing that those who will succeed in the nursery business must grow their trees by the most approved methods, we have begun spraying all our nursery stock with that famous mixture, beginning with the seedlings the first year, and continuing the operation several times throughout each season, until the trees are ready for market, and, as a consequence, the 'spray pump' and 'bordeaux mixture' has become as much the work of our nursery as running the cultivators." I have found the old proverb, "An ounce of prevention is worth a pound of cure," very forcibly illustrated to me in connection with my fall work.

The San Jose scale has been discovered and reported in several sections of this district. Where it came from no one seemed to know. I at once began a series of systematic inquiry, finding in every case the infested trees came from the same nursery some four or five years since. I then turned my attention to the site of the nursery in question, which is now mostly given over to other crops, but I found on old pear trees, on and near the same ground, scale in great abundance. My conclusions were that had this nursery stock been properly inspected at that time and treated to fumigation, there would be little or no scale today in the second horticultural district, and hundreds of dollars would have been saved to those who are now trying to exterminate the pests with costly sprays and labor.

Speaking in a general way, I have found the nursery interests of this district in a very thrifty and flourishing condition. Most of our nurserymen are awake to the facts I have referred to, and where proper remedies have been used throughout the season, such as bordeaux mixture, kerosene emulsion, and other equally efficient remedies, the stocks were comparatively clean. I found to a greater or less degree, however, wherever I went, the eggs of the hoplouse deposited upon the young prune stock. I also found in the two-year-old stock, especially of the cherry and prune, some symptoms of fungus disease. In each case I directed that all such stock

be fumigated with the gas treatment for insect eggs, and I believe it has been faithfully carried out. A portion of the two-year-old stock, in which were found symptoms of fungus, I requested thrown out and burned, which was largely done. This being the first year that we have given full attention to the nurseries, some of our nurserymen had never heard of the gas treatment, and many were the questions asked in regard to it. In view of this inquiry, the following facts have been collected by me from various authentic sources: Hydrocyanic acid gas was originally discovered, or at least applied to fumigation purposes, in 1886, by Prof. D. W. Coquillet, government agent, while experimenting in California for the extermination of scale insects. It is now used there very extensively for this purpose, the method being to cover the infested tree by means of a canvas tent, introducing the gas underneath. The gas is the result of chemical action by mixing cyanide of potassium, sulphuric acid and water, in proportions laid down in various published formulas. The cyanide of potassium is extremely poisonous, a very small amount of it taken internally or applied to a fresh wound being sufficient to produce instant death. Sulphuric acid is also a very strong chemical, and should be handled with great care. Hydrocyanic acid gas is poisonous when inhaled in quantities. Still, while these are facts and it is well to know them, the experience of several years in handling this gas throughout the country has terminated in few, if any accidents, any more than the handling of paris green or london purple, which are each deadly poisons, but whose use seldom results in accidents. The hydrocyanic acid gas is a little lighter than air, consequently it will rise in a fumigator, and is very penetrating in its nature. It is equally deadly to all insect life or eggs, killing insects by direct contact, and where eggs are found, by penetrating the egg, covering and poisoning the forming embryo within. It is not inflammable gas, nor will it ignite or explode. I witnessed a gas fumigation where woolly aphis was treated. After a half-hour had elapsed our close examination failed to find a single live aphis.

There is a phase connected with the inspection of nurseries and the treatment of stock which should very largely interest hopmen. The hoplouse, in the fall of the year, leaves the hopyards in the wing state, laying their eggs for the further propagation of the species on the plum, and especially on plum stock in the nursery rows. The following spring these eggs hatch, and in due time the lice find their way back to

the hopfields. Now, if these eggs are killed by fumigation when the nursery stock is dug, it will certainly destroy a large percentage of hoplice.

The nurserymen of this district are principally located in the vicinity of Woodburn, Salem, Albany and Tangent. The principal stocks carried wherever I have been are apples, pears, prunes and cherries, peaches being rather neglected. Ornamental trees are carried only by the larger dealers, and in such quantities as the demand requires. The acreage set to nurseries in this district I have been unable so far to definitely learn, but it is quite large, and constitutes one of our most thrifty enterprises. There is no risk whatever, after the experiments which have been conducted during the past few years by our agricultural department at Washington, in saying that, if properly treated with the various spraying remedies recommended, from the time nursery stock is budded to the date of marketing same, most, if not all of the known diseases and pests in this climate can be prevented, and that at a moderate cost. The facts have been well published, and next fall should see our nurseries clean and acceptable. Where this is not the case, there can be no excuse. My fieldwork proper has been delayed on account of inspection of nurseries and bad weather. However, there is much in sight to do, and many calls which will be promptly attended to and reported as soon as it is possible to accomplish same in a satisfactory manner.

The year closes with anxiety and hope for the coming season. Among our growers many thousands of dollars are invested in horticulture, the outcome of which means much both to the orchard men and the general public as well. While we hope and pray that none will be so unwise as to stand in their own light by refusing to help subdue the numerous pests which now threaten our industry and are a curse to their own orchards, and, while we will use every available means to open the eyes of such, if any there be, to a kindly adjustment of the matter, still I concur freely with Mr. Dosch, of the first district, that the time has come for taking positive measures. I would not be harsh or too hasty; I would use every means in my power to reason, and extend liberality as far as justice to the cause would permit; but if there be a case where all shall fail, then I should agree with the country school master, "One boy ain't going to ruin this school," and he picked up the switch.

Following the inspection of nurseries, but little active work in the field was attempted during the winter, excepting where regular calls were sent in for special work, it being considered the wiser plan to await good roads and the development of those orchard maladies which show in summer only. During June and July I drove over the district and visited as many groves as possible in the time at my command, besides looking up those persons in towns who are interested in the growing or handling of fruit. The objects in view and aim of my work while thus employed has been to examine each grower's orchard, as far as possible, and point out to him any diseases that might be observed and which in many cases were not known to exist, besides pointing out remedies for same; in personal contact, to impart all the information possible and gather from each grower his views and observations to be used for the good of all; to protect the horticultural industry under existing laws, where it has seemed proper and just to do so; to observe for publication in reports and free bulletins the various diseases, pests and facts in general pertaining to horticulture as they exist under varying conditions in different parts of the country. I have gathered much statistical information and succeeded, I think, in organizing the district so that much more and better work can be accomplished in the future, with less complications.

There has always been in the past a great demand for statistical information relative to the horticultural interests of the state which it has been impossible for the commissioner to give. In California the county assessor is required by law to collect this data, but no such law is in force in this state nor is there any other means provided for meeting the want in a regular manner. Realizing that I must have this information, relative to this district at least, I have undertaken and finished a personal canvas relative to these matters during the odd moments at my command while employed in regular field work. The results have been compiled strictly from my own field notes and I believe are as nearly correct as can be ascertained and not far from the facts either way. The totals as hereby set forth refer to the second district only and are as follows:—

MARION COUNTY—1895.

	No. of growers.	No. of acres.	No. of pounds.	Cars.
Growers owning orchards, one to eight years old	385			
Young orchards, one to eight years old		4,900		
Young prune orchards, one to eight years old		4,200		
Young pear orchards, one to eight years old		400		
Young apple orchards, one to eight years old		300		
Dried prunes produced			720,000	
Green fruit shipped				22

POLK COUNTY—1895.

	No. of growers.	No. of acres.	No. of pounds.	Cars.
Growers owning orchards, one to eight years old	108			
Young orchards, one to eight years old		1,258		
Young prune orchards, one to eight years old		1,000		
Young pear orchards, one to eight years old		50		
Young apple orchards, one to eight years old		200		
Dried prunes produced			112,000	
Green fruit shipped				2[illegible]

BENTON COUNTY—1895.

	No. of growers.	No. of acres.	No. of pounds.	Cars.
Growers owning orchards, one to eight years old	75			
Young orchards, one to eight years old		1,386		
Young prune orchards, one to eight years old		1,200		
Young pear orchards, one to eight years old		125		
Young apple orchards, one to eight years old		150		
Dried prunes produced			110,000	
Green fruit shipped				1[illegible]

LINN COUNTY—1895.

	No. of growers	No. of acres.	No. of pounds.	Cars.
Growers owning orchards, one to eight years old	85			
Young orchards, one to eight years old		1,211		
Young prune orchards, one to eight years old		950		
Young pear orchards, one to eight years old		100		
Young apple orchards, one to eight years old		150		
Dried prunes produced			218,000	
Green fruit shipped				2[illegible]

LINCOLN COUNTY—1895.

	No. of growers.	No. of acres.	No. of pounds.	Cars.
Growers owning orchards, one to eight years old	4			
Young orchards, one to eight years old		150		
Young prune orchards, one to eight years old		150		
Young pear orchards, one to eight years old				
Young apple orchard, one to eight years old				
Dried prunes produced			6,000	
Green fruit shipped				

LANE COUNTY—1895.

	No. of growers.	No. of acres.	No. of pounds.	Cars.
Growers owning orchards, one to eight years old	107			
Young orchards, one to eight years old		1,771		
Young prune orchards, one to eight years old		1,421		
Young pear orchards, one to eight years old		125		
Young apple orchards, one to eight years old		225		
Dried prunes shipped			288,000	
Green fruit shipped				30

RECAPITULATION—1895.

Age, one to eight years.

County.	Growers.	Total number of acres.	Total number of acres of prunes.	Total number of acres of pears.	Total number of acres of apples.	Total number of pounds of prunes dried.	Total number of cars of green fruit shipped.
Marion	335	4,900	4,200	400	300	720,000	22
Polk	108	1,258	1,000	250	350	112,000	3
Lane	107	1,771	1,421	125	225	288,000	20
Benton	75	1,386	1,200	25	156	110,000	1
Linn	85	1,211	950	100	150	218,000	2
Lincoln	4	150	150			6,000	
Total	714	10,676	8,921	900	1,181	1,454,000	57

In compiling the foregoing matter, no account has been taken of the old apple orchards from 20 to 40 years of age, from the fact that they are in small tracts, widely scattered and hard to get at in a thoroughly complete manner. However, an approximate estimate has been made as follows:—

OLD APPLE ORCHARDS.

County.	No. of acres.
Marion	5,000
Polk	3,000
Benton	3,600
Linn	4,000
Lane	3,500
Lincoln	800
Total	19,900

There were operated during the first season of 1895 the following evaporators:—

County.	No. of dryers.	Total capacity per day.
Marion	19	25,000
Polk	5	4,000
Benton	4	3,500
Linn	5	7,000
Lane	6	8,500
Lincoln	1	1,000
Total	40	49,000

Having now placed before your honorable body some conception, at least, of the magnitude of our rapidly growing fruit industry in this district, I will devote myself briefly to such matters of importance to the horticulturist as have been most prominently brought before me during my visits to various parts of the district, or by mail. To those who have seen years of active service and thoughtful experience in tending fruit trees, vines or other horticultural interests, it is almost unavoidable that they observe at times the striking similarity between the animal and vegetable kingdoms. True it is, there is a wide difference, and equally true the law of life, the crowning charm of both, are much the same. To treat a sick tree successfully requires much the same line of thought, knowledge and common sense as that which makes a physician among the people successful, perhaps the greatest difference being the responsibility of human life *versus* plant life. It is also well known by those who look into such matters that one half, if not more, of the ails of both men and plants are but local in results, or, in other words, they cure themselves after nature's own laws. Much worry is to be met with among our growers over the minor difficulties before them, while the real dangers are often undiscovered until too late and the tree

dies. It is not my purpose to advocate any less vigilance in our orchards than is now given, but rather to show when and how to treat trees without a useless expenditure of time and money. If one calls to his family the services of a physician, the very first step taken will be to make a diagnosis of the case in hand. Certain symptoms stand for certain diseases, and if all symptoms are absent, there can be no disease.

Many men are below the mark when we speak of robust health and still are not diseased, but, on the contrary, accomplish a vast amount of useful work. Precisely so we find it with trees. They are not all equal in vitality; some may appear weakly and still bear heavy crops of fruit year after year, but when any suspicious symptoms are observed, the first thing on the part of a grower should be to make, or attempt at least, a diagnosis. If the leaves are yellow and sickly, there must be some cause for it, and I should first look carefully for any small insects that might be living upon its leaves. Next, I would examine the bark of the tree above ground and out along the limbs for deadspot, gum or fungus. Failing in this, examine the roots; see if they are all healthy. Note whether there is moisture in the soil. Look for borers at the crown of the tree and just below. Watch for root knots below the ground, and also hardpan or standing water. I have seldom failed to locate the trouble with a sickly tree when carefully examined in this way, but where no unnatural conditions are found to exist further than a slight yellowing of the leaves, it is pretty safe to conclude the tree is only below the average in vitality and will live a useful life. I have often found it so. In case the trouble is located, a reference to the numerous bulletins and reports of the state board of horticulture will generally explain the trouble in full, and prescribe a cure. If not found there, better report it at once; it may save much future trouble.

APPLYING REMEDIES.

While a large percentage of our horticulturists have demonstrated to their entire satisfaction the great need and success of spraying and intuitively show their commissioner such results with pride, still I am often met with the argument, "I tried it and failed." Of course, it is possible that one may spray accurately and fail. Climatic conditions may be such as to defeat the best laid plans, but generally speaking, where this complaint is made there is something wrong. In

hardly an instance of this kind have I failed to find some direct cause for the failure. I have sprayed my own trees in the past, which, in the better knowledge of the present, I am satisfied did them no good. The first thing to ascertain is whether there is anything to treat your trees for, and what it is; but don't spray just for the sake of being in fashion, without knowing what for. This being decided, look up the remedy in your bulletins for that particular trouble, then follow instructions to the letter. If it says spray three times or four times, do so. Don't spray once and quit. Spray just when the directions say and not as convenience suits. Often the particular time given for treatment means everything. It is the difference between success and failure.

OLD ORCHARDS.

The problem of handling old orchards—mostly apple orchards 20 to 40 years of age—has been brought prominently before the board during the past year, and I have given much attention to that branch of the work in hand. There seems to be a general impression abroad that the law under which we work is an arbitrary affair, and provides for the wholesale destruction of old orchards. This is a mistaken idea. I do not understand there is any such authority given a commissioner, unless it be in a very exceptional case. He is, however, authorized to clean up, and by force, if necessary, all orchard trees, nursery stock, etc., which are found in such condition as to threaten the spread of contagious disease or pests, but only under conditions set forth in the following section of the law: "Section 9. The powers conferred in the two preceding sections of this act shall be exercised only in great and imminent danger to the fruit interests of the state and with the utmost caution and regard for the rights of individuals affected, consistent with the safety and welfare of the fruit interests of the whole state."

During the year there has been much activity among these old orchards in this district and a great deal of inquiry from owners of same, asking how to handle them to best advantage. All old orchards have not been renovated or cut down, nor could it be expected that the habits and customs of 40 years could be changed in any one year, but much has been done, and it is only a matter of time until all such orchards will be cleaned up or removed. It is largely a question of education as well as compulsion, for very few men refuse to clean an old

orchard when they fully understand the conditions existing therein, and, in answer to many inquiries, I mention the following facts: The objectionable features with most old orchards does not lie in the fact that they are old, moss covered or worthless to their owner, but because they are usually loaded down with infectious disease, insect pests, etc., which spread to our young and growing orchards with alarming results, where conditions are favorable. This is not generally understood by the owners, and I have several times during the season shown farmers that the disease in their young orchard came directly from old, scrubby trees near by and on their own place. It is possible to take one of these orchards and clean it up so as to be a source of fruitfulness and income to its owner, providing the varieties of fruit are good and worth the trouble. Otherwise I would graft them over or remove the trees entirely.

No one treatment, however, will thoroughly cleanse an old orchard. The disease is of long standing and must be treated like all chronic troubles. There are three leading and serious troubles generally found in an old orchard. The first and most serious is deadspot or apple canker; second, woolly aphis, and third, codlin moth. I would begin operations by pruning ut all old and crossing branches and spraying thoroughly with blue vitriol and water, 4 pounds to 25 gallons, soon after the leaves fall. Repeat the same in January and again just before the buds swell. This should kill the fungus spores, and, if kept up, eventually overcome the deadspot. For woolly aphis and codlin moth, treat as directed in bulletin No. 9, or in this volume under that heading. So far as I have been able to ascertain, the diseases and pests which harbor in our old apple orchards are not contagious to prune trees, unless it be shown that deadspot is the same as gummosis of the prune, a fact which so far has not been demonstrated by our leading investigators, but it is nearly impossible to grow a young apple orchard in close proximity to an old one.

DISEASES AND EXPERIMENTS.

Early in the year I undertook to carry out several spraying experiments to demonstrate by actual test several unsettled questions. The results have been unsatisfactory on account of the unusual climatic conditions which prevailed during the spring months. The same conditions which ruined the fruit also destroyed millions of insects and defeated some ex-

periments, there also being no fruit to measure results by. No alarm, however, need be felt over the extermination of insects ; there are plenty left for seed another year.

SAN JOSE SCALE.

Early in the season it became evident the San Jose scale had at last secured a foothold in this district. Several complaints were made to me which at once received my attention. I have found its presence in eight orchards, and in each case ordered treatment with salt, lime and sulphur wash, which was carried out. Later examinations failed to disclose any live scale, and it is hoped an early cure has been effected.

CLOVER MITE.

The myriads of clover mite eggs, which were mentioned in bulletin No. 9, I watched with much interest until the cold rains of April and May made further observations impossible. They hatched during the warm spell of weather, in early March, and spread out at once over the tender buds and leaves, seemingly bent on much mischief; but the rains and cold weather which followed seemed to be unfavorable to their life work and all perished, having done but little damage.

BORERS.

The peach-root borer is a pest long known in this state, but of late it seems to have partly been lost sight of, probably on account of more recent troubles which absorbed our attention. I consider it, and have found it, one of the most vexing and formidable foes we have to deal with in growing prune trees. It seems to work worse in some sections than others, but where it has gained a foothold very much work is necessary to subdue it. I have found a great many trees dying from and received many anxious inquiries about this trouble. It also attacks nurseries in some places, causing much trouble. I have invariably advised digging the worms out with a knife in the fall and spring of each year. It is the only means I have found successful in my experience. For further particulars see article under head of "Peach-Root Borers," in this volume.

DEAD ROOTS.

For the past 5 years I have observed this trouble in Oregon, but have seen but little reference to it in print. It occurs en-

tirely, so far as my observation goes, in prune trees grafted on peach roots. The first indication of the trouble is a yellowing appearance of the foliage about July 1 to August 1 and is found mostly with the Italian variety. Examination of the roots discloses the fact that part or all of them are dead. I never have been able to fully satisfy myself as to the cause of this trouble, and the only reference to it I have ever seen in print is as follows and was taken from the Pacific Rural Press: "It is believed that 'sour sap' is a fermentation of sap following stagnation, caused by decay of the fine roots through the soaking in standing water. If this root killing is partial the trees may recover, but its recovery is also conditional upon checking the exhaustion of the sap supply by exhaustion. Therefore, cutting back a tree which shows signs of sap souring is a rational method of treatment and it is about all that can be done for a tree with diseased roots."

Many trees have suffered from this malady this season and it would be wise for growers to examine the roots of trees showing signs of weakness and if found partly dead cut back the top at once. I have saved many of mine in this way.

DEADSPOT.

There are but few branches of experimental work which can be brought to a satisfactory conclusion in one season and such has been the result of my experiments this year with the above diseases. Acting under the advice of our best authorities, I selected the young apple orchard of Mr. H. Timm, near Salem, as the basis of a line of experiments to ascertain the practical results of spraying for deadspot, with which it was badly affected. The first treatment was given on January 29 with bordeaux mixture. A second treatment was given on March 9, just before the buds burst open, with vitriol and water, but owing to the loss of the fruit crop, no further treatment was given. Upon examination this fall I find no new work of the disease on the trees sprayed, while those not treated are as bad this year as ever. Mr. J. F. Peebler, near Albany, has a young apple orchard which last season was badly affected with the disease. During the winter he gave it two treatments with bordeaux mixture and when I was there we were unable to find any new work of the disease for this year. No doubt others have had a like experience, but these two orchards are the only cases brought to my attention where a special test was made for the subdu-

ing of this trouble, and from all appearances it has been successful. Deadspot is a disease found in every part of this district, but it is very much worse in some sections than in others. Local conditions seem to have some effect for good or bad. During the season of 1895 no one malady caused so much worry and apprehension among the growers of fruit in this section as that which we term gummosis. Trees everywhere and in all locations were dying. This resulted in great activity to ascertain what caused it and how to effect a cure. Much theory was advanced, but little actual knowledge based upon actual test was to be obtained. Realizing the necessity of practical tests and being interested in saving my own orchard, which was more or less affected, I have devoted some time to this trouble, but the results are not entirely satisfactory. Another year's experience may change results, but I give the following experience, partly my own and partly that of others, in the hope they may aid in throwing more light on the subject, and inspire close observation by all in the future and thus aid in arriving at facts. In the examination of old trees of the stone fruit varieties, mostly prunes and plums, I find old scars and other symptoms which clearly indicate this disease has been here for years. By cutting into the bark the same mottled appearance is found which is present in our young trees that gum so badly. In our young orchards—prunes mostly—those trees which were badly affected last year are this year looking healthy, the scars growing over and recovery apparently assured. Very little gum is to be found this season as compared with last and practically no trees dying from this cause. From these observations I infer the disease is periodical in its nature, depending upon climatic conditions which tend to aggravate or cure, according to the year. Acting upon the theory that a parasitic fungus is the cause of the disease, I selected a dozen or more badly affected trees last fall and treated them carefully with bordeaux mixture. From part of them I removed the outside bark and part I sprayed as they stood; some I wrapped with burlap soaked in vitriol water, and others not. All received three treatments with vitriol solutions in some form, and all are today looking perfectly healthy and well; they seemingly have entirely recovered. This would be very good evidence to me that a fungus was the cause of the trouble, were it not for the fact that trees equally as sick last year which received no treatment at all are recovering in every way just as well as those treated. Orchards treated and those

not show but little difference so far as this particular disease is concerned. To me it tends to show that no fungus exists in the disease we term gummosis. If it did, I should expect it to show every year in a tree not treated.

As to the relation of deadspot to gummosis, the following appears true the country over: Deadspot, or apple canker, never forms new bark entirely under a deadspot, but begins to recover by growing around the edges of the spot. Gummosis does often; yes, in half the affected trees of last year, new bark formed under what seemed to be a deadspot at first, and is now growing nicely. Vitriol treatments have cured apple trees affected with deadspot, while those not treated are as bad as in other years; but with gummosis all are looking better with or without treatment. Young apple orchards standing near old diseased apple trees have invariably caught the affection from the old trees, but prune trees have not. Now, if deadspot of the apple and gummosis of the stone fruits were the same, I should expect them to be contagious either way. These facts, it seems to me, are evidence that deadspot either works differently on a prune tree than on an apple tree or it is an entirely different affection from gummosis. My own belief tends to the latter. Observations relative to over-cultivation which has been held to aggravate or create favorable conditions for gummosis, do not tend to confirm that belief. I have found the disease equally as bad in neglected orchards as elsewhere, but on general principles I do not advocate over-cultivation. Moderation is my practice in this respect. Careful examination of affected trees discloses the fact that while the outward appearance of our trees do not show it, still the symptoms are still present, though apparently dormant this season. I believe when conditions are again favorable we shall have more trouble, and although I have no evidence today that a parasitic fungus exists in gummosis, I believe bordeaux mixture is a great invigorator of trees, and shall continue to use it for treating gummosis until I am entirely satisfied that no fungus exists.

FRUIT.

The insects and diseases which infest our orchards are an important and interesting subject to us all, but the day has now arrived when we are to add to these matters, those of equal if not paramount importance, the curing and marketing of our fruit products. The year 1895 found those

orchards of four years old and upwards heavily laden with magnificent fruit, and though it is but a small percentage of what is to come, there were many lessons learned in handling it. From my observation and talks with dealers in fruit products, I feel confident that a great advance must be made in our methods of curing prunes. Scarcely two men agree upon the subject, and hardly two driers can be found alike. Every one has a theory of his own in building an evaporator, and no two produce the same quality of fruit, but in their own opinion each has produced a perfect article. Many points relative to evaporating prunes are still unsolved, and can only be arrived at by careful, painstaking experiments and chemical analysis. This presents a vast field of work for both the state board of horticulture in the future and our experiment station at Corvallis as well. The fruit crop for 1896 has been a failure, except in a few exceptionally favored locations, where one fourth to one half crop of Silver and Petite prunes were found. This was owing to constant rain during the blooming season which prevented fertilization. The season of 1896 presented an interesting study of frost data and results. On March 2 and 3, following a spell of ten days and two weeks of exceptionally fine, warm weather, there occurred a frost which in its severity has no equal in the records of the weather bureau for that time of year in this climate. The thermometer on those dates registered 26°, or 6° below the freezing point. The buds were slightly developed, Silver prunes and peaches being in the lead; Petite and Italian prunes, cherries and apples were less advanced. Upon examination, soon after, it was found the Petite prunes had been quite badly damaged. No part of the buds seemed killed except the germ in the center of the buds, and they continued to grow and finally blossomed, but were, of course, barren. The Silver prunes and peaches, which were more advanced, escaped unharmed, as did the Italian prunes, which were less advanced. While this freeze did no commercial damage, as there was plenty left, it seemed to me to demonstrate that there is a certain time in the early development of fruit buds, before they open, when they perish of cold quite easily, and a very few days of retarded or advanced growth either way saves them. On the night of March 29 the mercury fell to the freezing point early in the evening and by 10 o'clock p. m. stood at 30°. Frost was forming rapidly on the grass, and it seemed that nothing could save the peaches and Silver prune, which were in full bloom. Some time after

midnight a heavy fall of snow occurred, and though the mercury did not rise above the freezing point before morning, no damage was done. The snow, which lodged in quantities on the blossoms, protected them until the next day when the warmer air relieved them. Later, on the nights of March 30 and April 2, heavy frosts occurred and did much damage, but an abundance was still left until the continued cold rains destroyed it all. It would seem from this experience that but little need be feared from frost as it occurs in the Willamette valley. Especially is this true when we have every reason to agree with the "oldest inhabitant" that this was the worst season on record.

During the year 1895 a vast industry was established in the fruit trade of Oregon. Commercial buyers east and west turned their attention to our fruits, in both the green and dried state. In this district, firms in Salem and Eugene shipped large quantities, and were extending their plans for future business. In every part of the state local buyers were preparing to handle the crop in their vicinity for 1896. I think it a safe estimate to say that 100 evaporators would have been erected in the six counties I have visited had the crop of 1896 proved a good one. Organizations for coöperation were everywhere being talked of, and warehouses erected to accommodate the same. The magnitude of the business would surely have been felt in all branches of trade, directly or indirectly, and while many feel the loss of their fruit keenly from the loss of its direct value, still I am inclined to think the loss in organization and establishing of markets, which would have gone on in a large way, is equal if not greater than the value of the fruit itself. Another year will bring into full bearing a large percentage of all the young orchards in the state, and if a full crop should prevail, which is quite probable, it will bring our industry, especially the prune output, from merely a nominal business to one involving large proportions. Enthusiasm should not be allowed to lag; preparations should steadily go on. This is a good time to build evaporators, while there is plenty of time, and no year could be better for experiments in curing, where any fruit can be obtained. No man ever succeeded by ceasing his efforts, but many enterprises seemingly hopeless have been pulled through to success by perseverance. From the satisfactory condition in which I have found the many young and growing orchards in this valley, and the anxious inquiries constantly pouring in for information, I feel confident

the horticultural industry of Oregon is on a firm and progressive basis. We may be somewhat depressed at the loss of a crop, but no halt has occurred. The work is in the hands of firm and determined men. The boat may be sailing through a calm, but her engines are still active, and her pilot at the wheel; and when the seasons shall again perform their yearly cycle, and our trees are laden with crimson fruit, the crowning glory of their lives, it will find us ready and able to handle the conditions which will place the first industry of Oregon in the front rank.

CHARLES L. DAILEY,
Commissioner, second district.

To the honorable state board of horticulture—

GENTLEMEN: I herewith hand you my first biennial report as commissioner of the second district for the state board of horticulture.

There have been some difficulties in the way of my making as full and detailed a report as I should desire. My appointment dates from July 8, 1897, having been appointed to fill the unexpired term of Mr. C. L. Dailey, resigned. In entering upon the duties of commissioner I found that no funds were available for the work of the board and, my own resources being limited, I was compelled to omit much work that should have been done, yet have tried to accomplish as much work as was possible under the circumstances. Correspondence has been carried on with fruit-growers in different parts of the district, and whenever it has been thought desirable I have visited different localities where fruit-growing was a prominent industry.

One of the first duties which devolved upon me was to inspect a shipment of Bartlett pears which came from California, consigned to the Oregon Fruit and Produce Company at Salem. These pears were found to be infested with San Jose scale, condemned and were destroyed by the consignees. The result of this action was excellent, as we have found no more infested pears placed upon our market. The insect is gaining a foothold in several parts of Oregon, and some severe measures may have to be taken in order to prevent serious injury to our fruit interests. It will be referred to in another place.

In the autumn of 1897 considerable time was devoted to the inspection of nurseries. This industry, which is closely allied to the interests of the orchardist, has become quite an important business in this district. There were a great many new nurseries started a few years ago, owing to the great demand for prune trees in this and adjoining states, but the planting of orchards during the past three years has not been continued to the extent it was during the boom in fruit-growing, and the mushroom nurseries have been forced to retire from business competition, so reducing the price of trees that it was no longer profitable. I believe, however, that the growing of nursery stock is again upon a business basis, and I wish particularly to commend the painstaking care of some of the well-known nurserymen in several places in the second district, who regularly spray their nursery trees and use every precaution to prevent the introduction of disease or insects among their stocks. I believe the nursery interests of this district are for the most part in good hands, and with few exceptions all are carefully observing the regulations of the board. There are now in this district 18 nurseries, situated as follows: Woodburn, 3; Salem, 9; Albany, 2; Tangent, 3; Oakville, 1. These nurseries were generally found in good condition, and certificates were granted all but one nursery, where San Jose scale was found, and the owner was instructed to take prompt and vigorous measures for its eradication. In addition to the inspection of nurseries, a number of shipments of fruit and trees were inspected.

ORCHARD INSPECTION.

At various times during the past year trips have been made into different parts of the district. During these trips as many orchards as possible were inspected, bulletins distributed and growers advised with in reference to the various questions which have confronted them. In this way portions of the orchard districts of Marion, Polk, Linn and Lane counties have been visited and plans have been made for systematic work in the future.

Upon request, I visited Fox valley and a part of King's valley, where, I was informed, an inspector had never been before. Here in these little valleys, far up in the mountains, I found a number of small prune and apple orchards. If an inspector had never visited these orchards, there was ample evidence that the omnipresent codlin moth and woolly aphis

had long since firmly established themselves in the little valley.

At one place visited, owned by Mr. Gardiner, I was shown an apple orchard which was planted 42 years ago. This orchard had been pruned and the trees scraped during the past winter, and the trees appeared thrifty, having beautiful, dark green foliage, and promised an excellent crop of apples. The ravages of the codlin moth, however, were already visible, and I was informed that it was the intention to spray them next season. Everywhere growers are encouraged by the excellent crop of fruit, and many are the requests for bulletins and literature relative to fruit-growing. The past season has also been an object lesson to those who neglected to spray their orchards, for they have seen their more progressive neighbors market from 50 to 95 per cent. of their apples at a profitable price, while their own wormy apples could only be sold to drying establishments or cider factories at greatly reduced prices. Fruit-growers must learn to cultivate, fertilize, spray, if they are to succeed in producing marketable fruit at paying prices, and I believe the board of horticulture is doing good work along the line of enforcing this lesson and teaching the proper methods of applying the knowledge thus gained.

RENOVATION OF OLD ORCHARDS.

We are often asked: "Will it pay me to clean up my old orchard?" This question cannot always be answered in the affirmative, yet I believe it can generally be so answered. Asked as to the proper method of procedure, I would make the following suggestions: First, go through the neglected orchard, examining the trees, and mark those which seem to be beyond recovery. These should all be grubbed out as the first step in renewing the orchard. In most old orchards the trees are much too close, and if there are still too many trees left on the ground, it will perhaps be advisable to remove alternate rows. Having determined which trees shall remain, these should be thoroughly pruned, cutting out all dead or decaying branches and heading well back. Having done this, the trunk and larger branches of each tree should be thoroughly scraped with a hoe or other instrument to remove the moss and old bark, thus destroying the hiding places of insects and allowing the spray to accomplish its intended purpose. Having burned the trees, prunings and scrapings which have been removed, the third step would be

spraying. This should be done with a knowledge of what the trees are to be sprayed for, as otherwise it may be labor and materials thrown away. If the trees are infested with scale insects they should be thoroughly sprayed with the lime, sulphur and salt, or lime, sulphur and vitriol compounds during the winter while the trees are dormant. If treatment for scab and codlin moth is all that is necessary a thorough spraying with bordeaux mixture during winter to kill the spores of fungi, and the usual spraying of bordeaux and paris green, as given in the spray calendar, will accomplish the desired results. As to the profit in thus restoring an old orchard, I will simply give a comparison of two adjoining orchards with which I am familiar. One treated as above averaged the owner $1 per tree net the past season, he having saved 60 per cent. sound fruit; the product of the other, containing nearly twice as many trees, but uncared for, was sold for $15 or about 10 cents per tree.

FUNGUS DISEASES.

Owing to the favorable climatic conditions of the Willamette valley, the various fungus diseases affecting fruits and fruit trees spread very rapidly, and in some seasons have done considerable damage. Especially was this true during the ripening of the prune crop in the season of 1897. During the summer indications were favorable for an excellent crop of Italian prunes, but just as the fruit was beginning to ripen we had several heavy rains, and immediately reports began to come in that the "Italian prunes are not right," or, the "Italian prunes are all rotten."

Investigation soon proved that this was due to the fungus *Monilia fructigena*, or brown rot, and it probably caused a loss of one third the Italian prune crop of the Willamette valley, a loss to growers of many thousands of dollars. Especially was this disastrous to those who shipped green prunes after the rains began. In many instances whole carloads were almost a total loss as a result of the rot. This caused the grower to lose not only his fruit, but boxes, packing and freight charges, and in a number of cases seriously crippled the shipper financially.

This year, 1898, comparatively few prunes were shipped green from this district; many more prune orchards were sprayed with a fungicide and a large number of evaporators were erected. The season, too, was favorable for the perfect

development of the Italian prune, and as a consequence, a a very large crop of fine prunes was secured. As there was very little loss the past season resulting from brown rot, the tendency will be, no doubt, to neglect to spray during the coming season. Prevention, however, is the only safe course, and we believe it is safer to insure our crops against disease. We would, therefore, urge that all mummied prunes found hanging to the trees be gathered and burned during the winter. This should be supplemented by spraying with bordeaux mixture just before the blossoms open, again after the prunes are well formed and again later if any indications of rot are found. These sprayings will also serve to check the shothole fungus *(Cylindrosporium padi)*, and the prune rust, *(Puccinia pruni)*.

Probably the best known fungus which injures fruit is the apple scab *(Fusicladiun dendriticum)*. This fungus is too well known to all apple growers to need any description. Yet very many apple growers do not seem to realize the loss suffered in consequence of neglect to properly spray for this disease. I believe many varieties of apples now considered shy bearers in this district would bear abundantly were it not for the attacks of the apple scab fungus. It is to this fungus Prof. L. H. Bailey attributes the cause of the apple failures in New York, as the following paragraph taken from bulletin No. 84, of the Cornell experiment station, will show: "The best proof that the apple scab fungus is the immediate cause of the greater part of the apple failures of Western New York is afforded by the fact that thorough spraying with bordeaux mixture is usually followed by a great increase in the productiveness of the orchard, and it may be said that the indifferent results which occasionally follows the spray are equal proofs that there may be other causes than the fungus for the failures. Many of the failures with the bordeaux mixture, however, are due to careless or hasty application. If the bordeaux mixture is properly made, using an excess of lime, no injury may be expected to follow its use, and it should be applied with great thoroughness. The operator should endeavor to completely cover all the leaves and shoots. A mere sprinkling, such as most persons give, is of little good. One thorough application which drenches the tree is better than several of the ordinary kind. Then people are always waiting for fine weather. Now, it is in the rainy weather that the fungi spread most seriously, and it is then that the spray is most needed. With plenty of lime the

mixture adheres well. Spray between showers, even when the trees are wet, if you can do no better. To delay is to fail. It is better to spray in the rain than not to spray at all."

Equally injurious to the apple crop is the larvæ of the codlin moth. This pest may in a large degree be easily overcome by adding paris green at the rate of 1 pound to every 200 gallons of the bordeaux mixture, care being taken to secure pure paris green, as this article is often adulterated. There is abundant evidence that apple orchards can be made to produce sound, marketable apples, free from worms, and return a fair profit to the grower if the trees are properly sprayed at the right time. Under date of November 21, 1898, Mr. G. W. Dimmick, of Hubbard, Oregon, wrote me about as follows: "I have 2,500 apple trees 5 years old; nearly all are Ben Davis. In 1897 I harvested about 30 boxes, and this year 2,500 boxes. I sprayed them the first of June, July and August with 3 pounds blue vitriol, 4 pounds lime, 2 ounces paris green and 2 ounces london purple, to 50 gallons of water, using the same formula at each spraying. In one orchard, unexposed to outside influences, I gathered 1,400 bushels of apples with 99 per cent. sound. From another orchard, which adjoined an unsprayed orchard, I gathered 1,100 bushels of apples with 95 per cent. sound. I believe most of the damage was done after September 1, and next year I intend to give an additional spraying." Mr. Dimmick sold his apples at a very satisfactory figure. The experience of a large number of growers bears out the statement that perfect apples can be produced if proper treatment is given. The results of spraying are very gratifying as given in reports received from fruit-growers in all párts of the district. Owners of unsprayed apple orchards report from less that 1 per cent. to 30 per cent. of sound apples, while from sprayed orchards come reports of from 60 per cent. to 99 per cent. sound apples saved.

SAN JOSE SCALE.

This insect has been found in several sections of the second district, and while it has not as yet done great damage, it must nevertheless be dealt with promptly or serious damage may result. And here we must urge the assistance of all fruit-growers, and those who have infested trees upon their premises, for in order to successfully control this pest we must have the hearty co-operation of all who have infested trees. During the winter a number of orchards infested with

scale were sprayed, and in some cases it seems to have been very effective. In others, while greatly reducing the scale, we have found some still left to continue the species, and these orchards will again be sprayed this winter.

The greatest difficulty met with in trying to combat the scale is in the town or city. Here the owners of city lots, containing perhaps three or four trees, are often careless or indifferent, and when instructed with regard to spraying their trees will often hire someone to give their trees a spraying and are satisfied if their trees look white, without regard to the effectiveness of the spray, thinking they have done their duty.

In order to secure effective work this winter, Mr. W. W. Walker has kindly offered to do spraying at a very reasonable cost, and it is hoped that better work will be done. Mr. Walker is familiar with the preparation of sprays, and is interested in seeing good work done, as he has for several years conducted a nursery in Salem. By inducing some competent person to engage in this business in each city, I believe the spraying of trees in city lots will be much more successful than it has hitherto been. Many persons owning orchards would be glad to employ persons who are thoroughly skilled in the preparation and application of the various sprays in preference to preparing and applying the sprays themselves.

SCALE ENEMIES.

On some trees infested with scale, I have found small, black ladybugs, which upon examination proved to be destroying the scale. Some of these little friends were sent to Prof. A. B. Cordley, of the Oregon agricultural college, and he identified them as the species of ladybug known as *Pentilia misella*. Of this beneficial little insect, Professor Cordley writes as follows in bulletin No. 45, published in June, 1897: "In the east the most useful of these ladybugs is a minute, black species, known as *Pentilia misella*. It is scarcely as large as a pinhead, and is shining black in color. Until recently it was supposed to be a distinctly eastern species, but in 1894 it was found at Marysville, California, and in March, 1896, Mr. H. E. Dosch, horticultural commissioner of the first district, sent me for identification specimens he had observed feeding upon the scale at Hillsdale." We cannot, however, rely entirely upon our little insect friends, but should be ready to battle effectively with properly prepared sprays.

The most effective of these is the winter spray of lime, sulphur and salt, prepared according to the formula given elsewhere in this report. Summer sprays are less effective, owing to the fact that sprays sufficiently strong to destroy the insects under the scales, would also endanger the life of the tree, while the female scale gives birth to living young for several weeks. Professor Forbes, of the Illinois experiment station, has found, however, that kerosene emulsion is of assistance in fighting the scale in that state.

FERTILIZING THE ORCHARD.

A number of inquiries have been received relative to the fertilization of prune orchards. These inquiries have generally been from growers of the Petite prune, since this prune, as a rule, ran to unusually small sizes the past season, and were, therefore, very unprofitable. Some growers have even suggested the advisability of destroying their Petite prune orchards, or grafting them to other varieties. This we believe would be very unwise, for the Petite prune orchard when properly cared for has generally produced one of the best paying fruit crops. Instead of destroying our orchards, we should rather determine the cause of our inferior prune and then endeavor to find a remedy. Bearing prune trees should always receive thorough cultivation. When very little growth is made, it may be advisable to raise a clover crop in the orchard during winter to be plowed under in spring. If a stand of crimson clover, or of vetches, can be secured, this is the cheapest way in which to furnish nitrogen to the trees. In answer to a letter addressed to Prof. G. W. Shaw, professor of chemistry at the Oregon agricultural college, relative to the fertilization of our prune orchards in the Willamette valley, I received the following reply :—

CORVALLIS, Oregon, December 12, 1898.

Mr. L. T. Reynolds, Salem, Oregon—

DEAR SIR: In answer to your letter of inquiry of recent date, I would say that if the physical conditions of our orchards are correct and they then fail to produce as they should, we may expect potash to be needed. This is the element in our valley soils that will need the first attention and it is the element that is the heaviest drawn upon. Some orchardists are already getting good results with its use. In an experiment conducted by us this year it proved of great benefit. In applying this — the muriate of potash is the cheapest to use — it should be mixed with two or three times its bulk of sand or coal ashes and applied broadcast and worked in with a harrow. The fertilizer should be applied in the fall or winter — at the

latest the very early spring—but the working in might be delayed till spring. No beneficial results will follow a late spring application the first year. An application of air slacked lime will also benefit a great many of our lands. Gypsum can also be used to advantage, as it will supply some lime and at the same time will set free potash that is in the soil in an unavailable condition.

Yours very truly,

G. W. SHAW,
Chemist.

As will be seen from the above letter, fruit-growers should not delay too long in applying potash to their orchards if they wish to gain any benefit from the application during the coming season. Nearly all Petite prune orchards visited during the past summer were carrying too much wood and were loaded with more prunes than they could possibly mature. In very many orchards, proper thinning out of the over-crowded limbs and a judicious cutting back of the tops would prove a valuable remedy for the small, tasteless prunes which are now produced.

THE COMMERCIAL FEATURES OF THE FRUIT INDUSTRY.

There is always a demand for statistics relative to the production and value of the fruit crops of the state. In order to gain some information in this direction, postal cards were directed to the different fruit-growers of the district, asking for the following information: No. acres in prunes; No. pounds dried prunes; average price per pound; No. acres in apples; No. bushels apples; percentage of sound apples. About two thirds of those addressed have already responded and from these reports, together with other available information collected, I have secured data from which I think comparatively accurate estimates may be made. As the acreage of fruit trees has increased very little since 1895 in the second district, for purpose of comparison, I insert a portion of a table given by my predecessor in the last published biennial report. This table contains the estimate of prune production for the year 1895, together with the estimated crop of 1898, and will be of interest as showing the large increase in the prune output during the past three years.

COMPARATIVE PRODUCTION OF PRUNES FOR YEARS 1895 AND 1898.

County.	*Growers.*	*Total number acres dried prunes.*	*Total number pounds dried prunes, 1895.*	*Total number pounds dried prunes, 1898.*	*Increase.*
Marion	335	4,200	720,000	2,975,000	2,255,000
Polk	108	1,000	112,000	825,000	718,000
Lane	107	1,421	288,000	860,000	572,500
Linn	85	950	218,000	395,000	177,000
Benton	75	1,200	110,000	875,000	765,000
Lincoln	4	150	6,000	20,000	14,000
Total	714	8,921	1,454,000	5,950,000	4,496,000

VALUE DRIED FRUITS, 1898.

County.	*Dried prunes, pounds.*	*Average price per pound.*	*Total value.*	*Dried apples, pounds.*	*Average price per pound.*	*Total value.*
Marion	2,975,000	$ * 0 03¼	$ 96,687 50	275,000	$ 0 06	$ 16,500 00
Polk	825,000	03¼	25,812 22	150,000	06	9,000 00
Lane	860,000	03	25,800 00	40,000	06	2,400 00
Linn	395,000	03½	13,825 00	100,000	06	6,000 00
Benton	875,000	03½	30,625 00	80,000	06	4,800 00
Lincoln	20,000	03½	700 00			
Total	5,950,000	$	$ 193,447 72	645,000	$	$ 38,700 00

* The difference in average prices is due to the fact that in some counties a large number of Petite prunes are grown and in consequence of their small size the average price received is less.

From the above tables it may be seen that the fruit industry is fast becoming one of the leading industries of the state, and we believe it is one the people of Oregon can well afford to foster.

LLOYD T. REYNOLDS,
Commissioner, second district.

REPORT OF THE COMMISSIONER

THIRD DISTRICT.

To the honorable state board of horticulture—

GENTLEMEN: I have the honor to herewith submit a report of my observations and experiences covering the period since my induction into office on the eleventh day of November last. My district, comprising Coos, Curry, Douglas, Josephine, Jackson, Klamath and Lake counties, is a very large one and the facilities for reaching some parts are not the best; this fact and the fact that my predecessor, Levi Morris, had, but a short time before my entering on the duties of my office as a member of the board, visited Klamath and Lake counties and inspected the orchards growing therein, made it inadvisable for me to take a trip out there this year. I have pretty thoroughly inspected the orchards and nurseries of Jackson county and have made several trips into Josephine and Douglas counties.

During the year, prior to October 1, I have received and answered one hundred and nine letters and mailed one hundred and twenty-seven of the board's bulletin, number nine. I have inspected eighteen bundles of trees and plants shipped in by freight or express and have inspected nine nurseries, three of them twice. Coos and Curry counties being so difficult of access have not been visited, but it is my intention to visit these counties during the coming fall or next spring. I have been informed that these counties are highly favored as to climatic and soil conditions for the production of choice fruits and nuts of nearly all kinds that are grown in Oregon. Douglas county is the banner prune-producing county in my district. I have not had sufficient time or opportunity to make anything like a census of my district, but I am satisfied that Douglas county is one of, if not the leading county of the state for the production of the prune. A large part of the prune acreage is of the Petite or French variety, which seems to find here all the necessary conditions for the most perfect development of the fruit; a large crop was harvested

in 1895, and the present year, while there was nothing like a full crop, in some places quite a heavy yield of the Petite was experienced, while the shipment of peaches from the Rogue-river valley was comparatively nothing this year as compared with last. Some parts of the Umpqua valley produced quite a crop of peaches for shipment. All the hardier fruits and any of the tenderer sorts that thrive in any place in Oregon can be grown quite successfully in most any part of Douglas county; in most parts of the county the trees are reasonably healthy and not infested to so large a degree with scale or other pests (except fungus), as the neglected orchards of Jackson and Josephine counties. While Douglas is the banner prune-producing county of my district, Jackson county leads all others in the district, if not in the state, in the production of apples and peaches. It has been my pleasure to visit one hundred and thirty-four orchards, representing one thousand eight hundred and twenty-seven acres, ninety-one home places, and as before stated, nine nurseries; the result of the inspection of the latter has been embodied in my field reports and forwarded to the secretary of the board. The largest and perhaps the most successful orchards in my district are those belonging to the Stewarts, near Phœnix. In these orchards is found nearly every kind of fruit and nuts, apples and pears, however, predominating. Mr. C. E. Stewart tells me he has been successful in the cultivation of the soft and paper-shell almonds, of which he has about forty acres. Altogether, the Stewarts have quite an acreage of this nut, and the probability is that the Oregon market will be supplied from these orchards in the near future. Around Medford and Central Point are many large and well cared for orchards, showing that horticulture has made rapid strides in this part of the valley. In the corporate limits of Ashland there are over eight hundred acres of fruit trees, mostly peaches. There is scarcely a residence in the city that has not more or less fruit around it, and these are the places where the pests have secured the greatest lodgment, particularly the San Jose scale *(Aspidiotus perniciosus)*. The large commercial orchards have been well sprayed and cared for. But the breeding places of the pests and those that it is the most difficult to get properly sprayed and cared for are the domestic orchards surrounding town and country homes. Realizing that the expense would be so great for individuals to fit up for spraying home orchards, and yet the urgent necessity of attending to these worst of all breeding places, I induced

several parties to go into the spraying business, thereby making it possible for persons having a few trees to get them sprayed at a reasonable cost. Most of them have done good work, so that now Ashland is pretty well cleared up and very little scale is noticeable. The San Jose scale had obtained such a foothold before the people knew what it was that at first the fruit-growers seemed pretty much discouraged. We tried the I. X. L. salt, lime and sulphur compound, and other remedies that came very highly recommended from California, but none proved satisfactory until we got the lime, sulphur and blue vitriol compound, which, after three years' trial, has proved entirely satisfactory in every case where proper care was exercised in its preparation and application. Climatic and soil conditions are much the same in Josephine as in Jackson county, and many fine orchards are to be found along the Rogue river and other parts of the county. The apple seems to be the favorite with the fruit-growers here, although peaches are grown quite largely; in fact, some of the finest peaches I have seen this year were grown by a man by the name of Mr. Crow, near Grants Pass. In some parts of Lake county really fine apples are grown, but the crop is not at all certain in any part of Lake or Klamath counties. Both of these counties being situated at a high altitude and east of the Cascade range of mountains naturally have much more severe weather than any parts of Western or Southern Oregon. The failure of the fruit crop in this region is not due so much to severe weather in winter as to late frosts in the spring. I saw some fine apples grown near Lakeview not long since. While they were not so large as the same varieties grown in Jackson county, yet they were highly colored and perfectly smooth and sound, showing no signs of worms or fungus, and I have no doubt in some sheltered localities fine fruit of the hardier sorts can be grown. The almost total failure of the fruit crop in Southern Oregon the last year has made it impossible for me to record any observations as to the methods of preparing for market; however, I might say that our most successful growers first prune their trees carefully and thoroughly; then, early in the spring, before the leaves start, spray thoroughly with the lime, sulphur and blue vitriol compound. When the fruit is about the size of hazelnuts every tree is gone over and the fruit thinned out. The rule for thinning is that no two peaches shall be nearer than five inches, that is, that the fruit shall be five inches

apart. At picking time care is taken to place the fruit of a uniform size in each box.

Immediately around Ashland the principal acreage is peaches, while around Phœnix and Medford is apples and pears. Considerable attention is also paid to berry-growing in Southern Oregon. A good market is found in Northern California for great quantities of strawberries and blackberries at remunerative prices. While speaking of berries I am reminded of a new berry that is coming into popular favor with us, and one that is destined to take front rank in the berry garden. I allude to the Logan berry; it is a cross between the blackberry and red raspberry; it is the size of the blackberry and the color of raspberry, with the combined flavor of both, the raspberry flavor predominating. I have fruited it for two years, and am much pleased with it.

The principal pests that the fruit-growers of Southern Oregon have to contend with are the San Jose scale, the green and woolly aphis, the codlin moth and the peach-tree borer. As before stated, the scale got a great foothold before the fruit-growers were aware of its presence; but since the lime, sulphur and blue vitriol compound has come into use we do not dread it, because we know we can keep it down. Success with this compound, however, depends largely on its preparation, which will be published in full in this biennial report. In addition to cleaning the tree of scale, it has been found that this compound is an excellent remedy for curlleaf in the peach, and it lessens, if not entirely prevents, the scab on the apples and pears. By thorough effort we can keep down the ravages of the codlin moth to the minimum. In spraying for this pest we use one half gallon of the above compound to 50 gallons of water, adding four ounces of pure paris green and four pounds of soap, made as follows: Take one pound of concentrated lye, three pounds of tallow; boil these in three gallons of water until it looks like honey, then add water to make five gallons; bring to a boil, done. Other soap will do as well, but this is cheaper. In addition to spraying about four times with this mixture during the season we tie a band made of a strip of loose burlap or cloth around the trunk of the tree, about two feet from the ground. This band is examined every week during July and August, and all larvæ found destroyed.

It was my intention to incorporate in this report something of a census of my district, but the means at my disposal are inadequate to accomplish anything like a complete census.

One man could, profitably to the growers and state at large, spend his time in my district. During the coming season it is my intention to make as complete a canvas of my district as the funds on hand will warrant, and I hope to make a subsequent report much more complete.

J. R. CASEY,
Commissioner, third district.

SUPPLEMENTARY REPORT.

To the honorable state board of horticulture —

GENTLEMEN: I have the honor of herewith submitting my biennial report for the years 1897 and 1898. Since my last biennial report I have visited a large portion of Douglas county and examined upwards of 1,800 acres of prunes, and I must say I never saw more healthy and vigorous prune trees than are growing in Douglas county. There is comparatively little San Jose scale, but some have planted on ground that was too wet, and here gummosis has taken hold and will have to be fought, and I have no doubt but what the fruit-growers of Douglas county will do it.

I noticed in the spring of 1897 that there was quite a large amount of dead wood in the fruit trees, more particularly in the peach trees; and about the first of May I received many letters from all over the district calling my attention to it, and asking what it was and what could be done for it. After careful examination, I found it to be caused by the hard freeze we had in November, 1896. The wood was not fully matured, so the hard freeze killed it or injured it to such an extent that it died soon after coming into bloom. The trees on the lowlands or in swails that had been irrigated suffered most; those on the high, rolling ground stood it the best. There were many trees killed.

Our fruit-growers in 1896 had very little fruit, caused by cold wet and frosts, and they neglected their orchards to such an extent that peach trees did not make a good growth of wood to bear the fruit of 1897, so they had to pay very dearly for their neglect, by its helping to make them an inferior crop of fruit.

In the latter part of May and beginning of June there appeared a growth on the peaches and apples that very much resembled the San Jose scale, but proved to be a fungus that

was unknown to us, but as soon as the weather became warm and bright it ceased.

During the spring of 1898 there were very few trees, shrubs or plants shipped into this district. I think this was owing to the fruit-growers failing to receive remunerative prices for their fruits in 1897. But in the peach belt of Ashland and vicinity there will be considerable tree planting done this season, as the peach-growers are very well satisfied with the prices they have received for their fruit this season, and I must say that the quality of the fruit grown this year is as fine as was ever produced in this district.

And yet it seems that as soon as we have learned to subdue one pest, we find a new one on our trees and plants. The curl-leaf on the peach tree is almost a thing of the past, and every intelligent fruit-grower knows just what to do with that greatest of all pests, the San Jose scale. We now have another pest or fungi that is working on the fruit and foliage. Specimens of it were sent to Prof. N. B. Cordley, at the experiment station at Corvallis, and also to John Minto, secretary of the state board of horticulture. Professor Cordley pronounced it a fungus commonly called the peach scab (*Cladasporian carpophillium*). He says it not only attacks the fruit, but also the leaf, causing shotholes, although it is not the ordinary shot-hole fungus. It winters in the young twigs, and can be prevented by spraying just before the buds open, with bordeaux mixture, then repeat the application once or twice after the buds fall. This fungi very closely resembles the San Jose scale. It has the same round, red spot, with the same gray center, but if you try to turn it over and expose the scale you will find that you cannot do it. It is more like an old sore eating into the fruit, and it spreads and becomes larger until, as I have seen some, the size of a 10-cent piece. We also have another disease attacking the peach. It is a fungus known as the brown rot (*Monilla fructigena*). This disease causes the peaches to decay rapidly, and they will not do to ship. This disease requires the same treatment as the one above.

The slug on the cherry and pear trees has been much less this year than for some time before. The destruction of foliage by them has been very light. The peach moth, or twig-borer, has done but very little damage the past year. The fruit-growers were getting alarmed about this pest, but they find that spray No. 2 holds it well in check. Since the

introduction of bulletin No. 9, Dr. J. R. Cardwell's article on "Pollination" is being much discussed, and most of them think it is a very fine, instructive article, and they see now why it was that some of their trees seldom bore a crop of fruit; that when partially grown most of it would drop off, and the rest would be imperfect in shape and form.

Another thing is now being agitated by the fruit-growers, and that is, what is the cause of weak, sickly trees? We will say a man has a block of 500 peach trees; why is it that some of them do so much worse than others? They are all of the same age, planted at the same time, have just the same care and attention that the trees surrounding them have had, yet they look badly and don't bear half the amount of fruit of the healthy trees, and that of an inferior quality. This occurs year after year. I think if we examine into this closely we will find that either the stock of the tree was grown from imperfect seed or that the scion or bud was taken from a weak, sickly tree, thus grafting or inoculating its own disease into the new tree, the result being a weak, sickly tree, that will always be annoying to the grower. I think if our nurserymen would use a proper amount of care and have only good stock to work on, and only bud or graft from good, vigorous, healthy trees, we may reasonably expect to have good trees; to plant trees that will make the growers feel proud of their orchards and fruit, from which they may reasonably expect a remunerative profit.

It is folly to expect good fruit from weak and sickly trees. Trees of this kind need all the nutriment they receive from the soil and air to keep life in themselves; then how can we expect them to produce good fruit? In most cases it will be more profitable to grub out these trees and replant.

The fruit-growers are getting to understand much more about growing fruit and trees and caring for them than they used to. Take, for instance, only a few years back and see how they used to explain the causes why their fruit failed. If the fruit fell off the tree when but partly grown, they claimed it was the frost. If they had the curlleaf, it was the frost. If it was cold, wet and no sunshine during the time of pollination, and very little fruit set on the trees, it was the frost. If canker, gummosis or almost anything else was the matter with the trees, it was blamed to the frost. How is it today? If the intelligent fruit-grower sees that it is cold, wet and no sunshine during the pollination, he knows at once he will not have much fruit that year; if he sees that

he has canker, gummosis or curlleaf, he don't blame it to the frost, but puts the blame where it belongs, and that is, in not vigorously using the spray pump at the proper time. Yes, the fruit-grower now knows that to have good fruit he must intelligently know how and when to properly use his spray pump with the proper sprays.

Respectfully submitted, J. R. CASEY,
Commissioner, third district.

October 10, 1898.

REPORT OF THE COMMISSIONER

FOURTH DISTRICT.

To the honorable members of state board of horticulture —

GENTLEMEN: I have the honor of submitting herewith my fourth biennial report as commissioner for the fourth horticultural district of the state of Oregon, comprising the counties of Wasco, Sherman, Crook, Gilliam and Morrow. It is very gratifying to note that the fruit industry of our great state is rapidly growing in importance in that part of my district which is bounded on the east by the Deschutes river and west by the Cascade range. The fact that during the past year we have shipped to the east from this limited area thirty-two carloads of green fruit and five carloads of dried fruit, while at least as much more has gone to local points by express and steamboat, is sufficient evidence of the actual progress made in the fruit-growing industry. My observations lead me to the conclusion that much of this progress is undoubtedly due to the better care and attention given to the fruit-bearing trees, whereby the orchards have become more exempt from the many insect enemies than ever before. This, in particular, is the case with the San Jose scale pest; and in many orchards throughout my district, which at one time were badly affected by this pest, the decrease is steadily going on at a gratifying rate.

CHOICE OF LOCATION.

Many fruit-growers are not careful enough about selecting a proper location for their orchards. This is one of the most important points for the intending fruit-grower to consider, and it should therefore receive careful attention. The land, if the surface is level, must be well underdrained in order to insure a healthy growth of fruit trees, especially in the case of cherries. Where the land is rolling, the northern slopes are the best. This is somewhat contrary to prevailing ideas on the subject, but, as a matter of fact, whoever will examine

the character of the soil and vegetation in my district, will find that the northern slopes are generally richer, and most, if not all, of our timber is to be found on these slopes. Experience proves that the soil, which in a state of nature furnishes a rich growth of vegetation, can be relied upon by the fruit-grower.

SELECTION OF TREES.

No less important an item in starting an orchard is the selection of trees. It would seem that many of those who go into fruit-growing make it an object to buy cheap trees. As a result of such an investment they get small, sickly and stunted trees, requiring two or three years before they get into a condition to grow. I always advise those who intend to plant an orchard for profit or for pleasure to buy nothing but heavy yearlings, not less than 5 feet from the graft; if such cannot be had, then the next best thing to do is to buy 2-year-old trees. Most of the fruit trees that are planted in this district come from the Willamette valley. Anyone can readily see that trees which are long on the road, and handled *en route* time and again at different points, become somewhat dried out, the smaller and weaker ones drying out more readily than the larger and stronger ones. Hence the necessity of obtaining larger and stronger trees and, whenever possible, from the nearest point.

VARIETIES OF FRUIT.

A careful examination into the question of varieties of fruit that are best adapted for this section, and which are of most value from a commercial standpoint, gives the following result:

Apples—Summer: Red Astrachan, Early Harvest. Autumn: Gravenstein, King of Tompkins County. Winter: Yellow Newton, Spitzenberg, Baldwin and Winesap.

Apricots—Moorpark.

Cherries—Royal Anne, Black Republican, Black Tartarian and the Lambert (a new variety).

Grapes, for table use—Black Hamburg, Rose of Peru, Sweet Water, Royal Muscadine and Muscatel.

Peaches—Amsden, Hale's Early, Foster, Salway, Early and Late Crawfords.

Pears—Summer: Early Madeline and Bartlett: Autumn: Fall Butter and Flemish Beauty. Winter: Winter Nellis and Beurre Easter.

Plums—Peach Plum, Columbia and Bradshaw.

Prunes—Italian, French and Silver prune.

This list is a result of observations throughout the district as to the adaptability of the different varieties of fruit to our soil and climate, as well as of repeated inquiries among commission men at Portland and the sound cities. Some of the varieties indicated may not do as well in other portions of the state, but it must be remembered that the territory east of the Cascade range is altogether different in soil and climatic conditions from that of either northwestern or southwestern portions of the state, and about these the commissioners from those respective localities are better prepared to indicate the varieties that would best answer their requirements.

PLANTING.

One of the most frequent and serious mistakes in tree planting is that of crowding the trees; and this applies to all kinds of fruit. Downing insists on a distance of at least 30 or 40 feet for apple trees. It seems, however, that there are many who think they know better than Downing, and allow only 25, or even 20 feet. But as time rolls on, and the trees attain an age of about 10 years, the branches begin to touch, and thus making it more difficult to properly care for them, and at the same time the fruit, being deprived of sufficient sunshine, deteriorates in quality, since good fruit always requires all the sunshine it can get. One may quote Downing for their benefit, and advise them often enough until it would seem they are fully convinced; yet, when visiting them at some future time, if they only had had an opportunity to make some additions to their fruit trees, one finds very often that the same error has been committed. Another common error in tree planting is that some are in the habit of planting their trees too deep, while others fail to plant them deep enough. The proper depth, as determined by experience, is about 1 inch deeper than the tree stood in the nursery. In transplanting, the tree should always be placed in the same direction to the prevailing wind as it stood in its original position, and it should be done when vegetation is the least active. In trimming, care should be taken not to overdo the work; there is more harm done by trimming too much than by not trimming at all. The time for this work is the early spring. If the average fruit-grower will make it his business to attend to

the planting and caring for his fruit trees as diligently as do those engaged in stock-raising, he will be amply rewarded.

INJURIOUS PESTS.

In the matter of orchard pests, I find that the codlin moth appears to be one of the worst pests our fruit-growers have to contend with. While I do not believe we will get entirely rid of them, still it is safe to say that, with proper precautions, about 80 per cent. of the apples can be saved; and this was fully demonstrated by Judge A. S. Bennett, who, by spraying his orchard, saved fully 80 per cent., while his neighbors lost most of their fruit crop. Indeed, spraying at the proper time will do much good; so will the band system, but the bands should be examined every week or 10 days, else the work will prove of little or no value. In the battle with this insect enemy one very important item is to keep all rubbish out of the orchard and of the places where fruit is packed or cider made; these are often left with rubbish accumulations that become the very worst breeding places the moth likes the best. Storehouses for winter keeping of fruit should be kept carefully closed from about May 1 to July 1, or the openings should be provided with some close wire netting; this will prevent the miller that has laid in the pupa state from getting abroad to reproduce his kind. Some personal experience has convinced me of the beneficial effects to be derived from thus protecting the openings of storehouses for the winter keeping of fruit, and whoever will try this will soon become convinced of it.

Grasshoppers have done some damage during the past two years, but, as a general thing, not to so great an extent in the orchards as elsewhere. Many experiments have been tried to get rid of them, but so far the only effective remedy found is the arsenic mixture. It is needless to say that it is as dangerous to stock and poultry as it is to the grasshoppers—not only the mixture itself, but the poisoned grasshoppers, should they be eaten by any farm animal, are liable to cause death.

I have had considerable experience in my district with the San Jose scale. Continuous spraying with the lime, sulphur and salt mixture has almost entirely eradicated this pest. This is a fine wash and gives the tree a good appearance, even if it is not affected with scale or insects. It is, perhaps, needless to say that every orchardist should possess a spray pump, and it is always good to buy the best. Such as are provided

with leather packing in the valves should be avoided, as they will be a source of much trouble. But whatever pump one sees fit to select, it should be well cared for and always cleaned and oiled after using. Spraying must be done properly, otherwise it is not only of no value whatever, but it is absolutely a waste of time and expense. Beginners particularly should bear this in mind. When spraying for the San Jose scale every inch of the tree should be thoroughly covered, for one or two inches left anywhere uncovered may furnish scale enough to cover the whole tree in the course of a season.

BIRDS.

Generally speaking, birds are the best friends of the orchard, and every fruit-grower and gardener should not only see that they are spared and protected, but that they are encouraged. As a rule, the smaller the bird the more useful it is, and of all schemes and inventions devised by the ingenuity of men to keep the orchards clean of rubbish, pests, etc., the birds are the most effective. Our native singing birds seem to prefer the trees about the house to those of the forest. Be sure to protect them; they will help to protect your orchards and will cheer your homes with their delightful songs throughout all the year.

MISCELLANEOUS.

I have visited all of my district during the last season, from the Cascade Locks, in Wasco county, to Mitchell, in Crook county, and found a fair fruit crop, but not as large as usual. The portion of my district on the John Day river, and that along Bridge, Cherry, Kirk, Pine and Rowe creeks I visited for the first time, and have found the soil along the creek bottoms well adapted for fruit-growing; the soil is rich and well underdrained. In the orchards owned by Charles Hilton, on Pine creek, Gilliam county, I found an apricot tree measuring 3 feet 11 inches in circumference; a cherry tree 3 feet 9 inches, and an apple tree 3 feet 8 inches; the tops of the trees in good proportion to the trunks; the apple tree covering a space of 30 feet and loaded with fruit. These trees are not over 18 years old. There was some complaint last spring along the Columbia river, west of the Deschutes river, about the "curled leaf" on peach trees, caused by the cold, backward spring. I also found some of the apple trees badly affected by "sour sap," due to the warm weather in February

starting the sap which afterwards froze under the bark in March. Pear trees were also somewhat affected by the same trouble; but this, however, was generally the case on land poorly underdrained.

CONCLUDING REMARKS.

Fruit-growing has attained the dignity of a profession. As an occupation it is healthful, pleasant and profitable for those who engage in it. Both Dun and Bradstreet report a much smaller percentage of failures among fruit-growers than among farmers and business men generally. As a rule, orchardists are well to do, and even the small fruit-grower can always rely on a sufficient income to enable him to live comfortably. But the fruit-grower must, however, remember that in his line of work, as in any other, there is always a chance to learn something. Observation and experience are the best teachers, and our constant endeavors should be to profit, not only by our own results, but also by those of others.

Respectfully submitted,

EMILE SCHANNO,
Commissioner, fourth district.

SUPPLEMENTARY REPORT.

To the honorable members of the state board of horticulture—

GENTLEMEN: I have the honor to submit herewith my report as commissioner of the fourth district, for the years 1897 and 1898. My district comprises the counties of Wasco, Sherman, Gilliam, Morrow and Crook. A great deal of interest has been taken in planting orchards in my district during the last two years, and decided improvements are manifest in the condition of orchards generally throughout the district, and, having examined all the orchards, I am prepared to say that the fruit industry is largely on the increase. More fruit trees were sold the last summer than in any former year. The year 1897 seemed to be the saddest to the fruit-growers, but last year (the year of '98) they had an excellent season, with satisfactory prices. Those who had peach and apple orchards have realized good prices for their fruit. The Italian prunes that were shipped from here this summer for the eastern markets have not turned out very satisfactory, but I

think it is mostly the fault of the shippers themselves. They shipped the prunes too early. The fruit was not ripe enough, and, in a great many instances, it was poorly packed. In nine cases out of every ten it was found that the poor prices received for the fruit was largely the fault of the fruit-growers themselves. They did not, in most cases, have their fruit packed properly. The eye is usually what buys the fruit; if it is neatly packed and in a neat box, it will sell almost every time. Those who shipped Hungarian prunes have fared much better and received pretty good prices. The Hungarian prune is not so good a prune as the Italian, but it has a neat appearance and the appearance is what makes it sell. Those shipping peach plums have done fairly well, also.

The damage to the fruit trees by the severe cold in November, 1896, on the 26th, 27th and 28th of the month, was quite extensive, especially in the western portion of my district. The thermometer went to 6° below zero when the foliage was still on the trees, and in a great many instances the bark bursted from the trunk of the trees. I found more trees injured on heavy clay soil, where the soil was packed hard — where the ground got quite dry during the summer months. Where the early fall rain made the trees take a second growth, these trees were damaged the worst; likewise, orchards that lay on the south side of the hill, where the sun strikes in the afternoon. I have seen orchards, half of which lay on the south hillside, and the other half on the north hillside. The half on the south hillside were mostly all killed, while the half on the north hillside were not injured a particle.

There are several orchards in Hood River, the trees of which stand in strawberry patches, where the berries were irrigated through the summer months. These trees were not injured. And in the same patch, right alongside of the other trees, were some that were not irrigated at all, and 50 per cent. of these were injured, and Mr. E. L. Smith will bear me out in the statement that trees which are irrigated less than others will receive the greatest injury. Mr. James Lacy, of Hood River, has about five acres of 6-year-old Spitzenbergs, and every orchardist knows that the Spitzenberg is a very tender tree. Mr. Lacy did not lose one out of the whole lot of over 300 trees. He had cultivated his trees up to very late in the fall. I know of another instance where the fruit trees stood alongside of an irrigating ditch, and not one of them was killed. I found, where the grasshoppers had injured the trees through the summer months, say in the month of

August, 1896, those trees had taken a second growth, and every one of them was killed. In the summer of 1897 I visited the fruit farm of Dr. Blalock, at Blalock station, Gilliam county, and out of 20,000 fruit trees, I did not find one that was injured by the cold weather in November of 1896. This orchard is on sandy soil. This has only reference to the apple and pear trees. With cherries, it is altogether different. Where they were irrigated they were badly damaged, especially the Royal Annes. There are several large orchards around Grant station, in Sherman county, where the water ran through the orchard all winter, and I did not find any of the trees injured by the cold weather of the winter, but where the orchards had been neglected, and where the trees were stunted, and an early fall rain had come on, the trees have taken a second growth and such orchards were badly damaged.

I am glad to report that at last a natural enemy has made its appearance in some of our orchards that have been affected with the San Jose scale, and the scale are being destroyed. It is a small, black ladybug. It is also called a brown-necked ladybug. Some of the orchards that I visited in June I found badly affected with scale, and when I visited the same orchards again about September I found no scale whatever. The orchard of Mr. Charles Denton was one of the worst orchards in this district, and I was not able to find a single scale on examining the fruit that Mr. Denton brought to market; it was absolutely free of scale. Several of the fruit-growers have mentioned to me that they think the San Jose scale is disappearing. This is only in the immediate vicinity of The Dalles; and I noticed that there was no fruit brought to market in The Dalles this summer that was in any way affected with the San Jose scale. I also have noticed that the scale that was on the pine timber has also disapeared for some reason or another. Still, I observe in other localities where I have not before been able to discover any scale, and where I have never known it before—in some portions of Gilliam county—several of the orchards along Rock creek are affected with it.

The codlin moth is still with us. This is an insect that is not as easy to get rid of as scale, but I am satisfied that it can be managed if properly handled. I know of several fruit-growers who have saved from 85 to 95 per cent. of their apples, and right alongside of their neighbors who did not save any at all. The men who have rented the orchard of Judge A. S. Bennett have saved about 85 or 90 per cent. of

their apples. They have been spraying for the last three years, and it is quite apparent that they understand their work better than most of the fruit-growers around them. They sprayed this season 11 times over a 10-acre orchard, at an expense of $125. They also used the band system. They had this fall from 1,000 to 1,100 boxes of good, sound apples. If they had not sprayed, they would not have had any apples, the same as their neighbors.

There are a good many of the fruit-growers in Hood River that have sprayed this year for the first time and they had splendid results, and I am satisfied that in course of time they will do still better. A person wanting to be successful in spraying for anything needs to study the habits of the insects first. If he does not, he will always be working in the dark. It is like a general of an army; he must study the workings of his enemy, and thus be prepared to deal with him. With most of the fruit-growers that have codlin moth, it is mainly their own fault that the moth is allowed to propagate on their farms. My advice to everyone that has an apple house about the place would be to close it up in the spring and put wire screens over all the doors and windows, because these apple houses are full of larvæ, and they hatch a miller in the spring and in the night they fly out to the orchards and lay their eggs, the first one laying the egg in the blossom end of the apple. There are also places on the farm where there may be a packing house filled with old apple boxes. These ought to be all cleared up and burned, so that there will be no chance for any codlin moth to hatch therein. If you examine one of these old apple boxes, you will be astonished to discover what an enormous amount of larvæ they contain, and these larvæ will make a moth and the moths sting from 200 to 300 apples in one night. It would be well if the fruit-grower would secure some of these larvæ and keep them in a bottle until about from the first to the fifteenth of June where he can see them hatch out a full-grown miller.

There is one locality in my district that does not have any codlin moth whatever—at least I have never been able to find any—and that is in the Mount Hood district, at Hood river. That is one of the best apple-growing sections in the district. The season is quite short. The days are very warm and the nights are cold; and that is the proper climate for apples. The apple is naturally a production of a cold climate, and it does a great deal better where the nights are colder than where they are so hot. Along the Columbia river the

season is too long for apples, and too early in the fall, and for that reason they will not keep. The best locality in this district for apples is not yet under cultivation. It is that portion which lays at the foot of the Blue mountains in Eastern Oregon, at an elevation of about 2,000 feet; and, also, the eastern slope of the Cascade mountains at an elevation of about 3,000 feet.

I also find that there are less codlin moths in places where timber is growing. I think the reason for this is that there are more birds in such places; at least, I find a great many birds feeding on the larvæ of the codlin moth and aphis. The black-capped chickadee is one of the most beneficial birds we have. This bird stays with us the whole year, summer and winter. There are about six or eight other kinds of birds that feed on the insects. It seems to me that there should be a law passed by our legislature to protect our birds. There should, also, be a law passed to prohibit the selling of airguns. I noticed last winter, about Christmas time, nearly every boy in the town where I live had one of these airguns. There was a vacation of school for two weeks at about that time, and all the boys were out with their airguns, killing birds. I saw dead robins most anywhere I went that had been killed by these boys. Even if the birds do not do us any good, it seems to me that they should be protected. Homes are really made cheerful by having them around the trees, in front of one's dooryard.

I find the green aphis has done a good deal of damage in some communities of my district, and especially to the apple trees. Last summer I heard a great many complaints, particularly along the creek bottoms where the trees were irrigated, that they were badly affected by the aphis. I also have noticed that a new insect has made its appearance in certain localities. It is known as the box elderbug. These bugs congregate in groups on the trunks of trees. I have also seen them on the side of an old house, where it was warm. They look almost the same as a swarm of bees. The principal damage done by this insect is in sucking the juice out of the fruit. I have only found them in places where the orchards are located alongside of a rocky bluff or in some canyon. These rocky bluffs afford them an opportunity to remain through the winter. Hon. L. O. Howard, U. S. entomologist, recommends spraying the trees in the early part of the season with kerosene emulsion. This will result in the death of a majority of insects of this kind. When they

crowd together on the trunks of trees they can readily be killed with hot water; or, probably, if they were scraped off into a kerosene can they might be disposed of sooner. A little industrious work at this time of the year will greatly reduce the number of insects the following season.

There are a great many mistakes made throughout this district in planting too many varieties, especially of apples. If the apples that went to waste this fall had been winter varieties, in the place of summer and fall varieties, they would have brought to the fruit-growers thousands of dollars. The best thing to do when one wants to plant an orchard is, first, to find out which variety does the best in his locality, and then ascertain which one it is that sells the best, or the one that brings the most money. I find quite a number of fruit-growers who do not even know the names of their fruit. I would always recommend against experimenting on any new variety, but stay with the old standard variety. It is the same with the peaches. They plant too many varieties also. No one ought to plant more than about four or five varieties of peaches, say one early variety, then three summer varieties and one late fall variety. I think the Early and the Late Crawfords are two of the best peaches we have. The Charlotte is also a good peach and the Salvay is a late peach. The latter is an excellent peach to sell from which to make money. These varieties are about the best in the vicinity of The Dalles.

Again, I find that there are a great many mistakes made in planting the trees too close together. In most every orchard that I visit I see that the owner has his trees planted too close. I generally have a conversation with them on the subject, and they usually admit having made a mistake. At the same time, however, when I come back in another year or two, they have done the same thing over. More than 75 per cent. of the orchards in this district are those where the trees are planted too near each other. I know of a good many of the orchards where the trees are not planted over 15 or 18 feet apart, and they ought not to be less than 30 feet, and 35 feet would be still better, especially for apples, and not less than 20 or 25 feet for peaches and prunes, and 25 to 30 feet for cherries. In planting a young orchard the ground ought to be well plowed and subsoiled. The trees ought to be not less than 5 feet high, and after they are planted they should be mulched with some barnyard manure. And the trees ought to be well trimmed for the first two or three years; then,

after that, they should be let alone, only cut out some of the cross limbs, but never cut out any of the outside limbs. My experience for the last six years has been that there is more harm done to young orchards by trimming and cutting away their limbs than any other thing that I know of. I have been at several fruit-growers' places in Hood-river where they have young orchards, say eight or nine years old, and their trees have never borne any fruit yet. They have asked me what the trouble was with their orchards. I tell them that they trim too much and are cultivating too much. That is the reason that the trees do not set any fruit sprouts. They grow nothing but long water sprouts. I advised them not to prune any more and not to cultivate so much, and their orchards would bear fruit. The first year they had a fair crop of fruit, and I am satisfied next year they will have a pretty good crop. Some of the fruit-growers have been in the habit of using coal tar on their fruit trees in places where they cut off limbs, and this is quite an injurious practice. I would not advise anyone to put any coal tar on any kind of a tree. Last summer I found a young lady who had a three-year-old apple orchard, consisting of about 10 acres. Someone had advised her to wrap the trees with tar paper and keep the mice and insects away from them thereby, and in about six months after that the trees began to drop over and fall down on the ground. She had the tar paper removed from the trees and had stakes cut, then staked the trees to keep them from falling, and no doubt within a year or so her trees will be all right.

There is another matter that some fruit-growers do not seem to understand, and that is this: Very often they cut down an old orchard, and attempt to plant a new orchard on the same ground where the old one was. I keep advising them that they cannot do it, as not a tree will grow in the same place where there has been a fruit tree before. A good many of the fruit-growers will laugh at me and make light of it, but they soon find out, to their sorrow, that I am right. I know of one party that planted a 60-acre apple orchard, in one corner of which stood an old apple orchard of about six acres, and they were good, healthy looking trees. I suggested to him that it would be best not to cut them down, but to let them remain where they were. However, he went on and cut them down and grubbed them up, and planted young trees in their places. I told him he had made a mistake; that he would never be able to make trees grow on the same ground where

that old orchard had been. This was about three years ago —so his young orchard is now about three years old—and the young trees have all made a very good growth, except on that particular spot where the old apple orchard had been. The trees are still alive there and are about the same size as when first planted. You may plant cherries, peaches or prunes in a place where apple trees stood, and then they will not do very well, but you never can plant an apple tree in the same place where one had stood before unless you remove some of the soil and haul in three or four loads of new soil into the place, and then there is a possibility of getting the trees to grow.

While I was in the Grand Ronde valley this fall, I found several eastern parties there who were buying apples for the eastern market. They ship their apples back to Kansas City, and keep them in cold storage until spring, when they are sold. They tell me that there are some varieties of apples that keep better in cold storage than others. It would be well for fruit-growers, intending to plant an orchard for commercial purposes, to find out the varieties that keep the best in cold storage. One of these gentlemen from the east promised to give me the names of the best varieties. I invited one of those parties to come down to Wasco county to buy his apples. The excuse he gave me was that he could not get enough apples here; that he wanted about 15 or 20 carloads. This will show that the fruit business is not overdone as yet. Anyone that raises a good-keeping winter apple will have no trouble in selling the same. Better prices can always be obtained if one has three or four carloads rather than where he has only two or three hundred boxes. I met one fruit-grower in Hood River last summer who told me that he did not know what he was going to do with his apples. I asked him how many boxes of apples he had, and he said about 800 boxes. I told him if he had about 10,000 boxes. he would be able to sell them much quicker, and get far better prices for them than he could for only the 800 boxes. However, he sold his apples this fall, all to one man, realizing $600 for the same, and he did not have more than five acres in trees, and these were about eight years old. He still has about 200 boxes of apples left for his own use; and all his expensss in taking care of such an orchard did not amount to over $30.

GRAPE—GROWING IN EASTERN OREGON.

"It seems, in all ages of the world, and in all climes where the fruits of the earth are most luxuriant, that the grape has ever been considered the highest type of fruit that nature, with lavish hand, has bestowed upon mankind. In both sacred and profane history no other fruit of the earth is so frequently mentioned as the grape, especially if we include the products thereof; and no other vegetable growth is so often employed in the way of figurative illustration as the vine. The history of the vine is contemporaneous with the history of man; but the grapes of Eschol could not have been more attractive to the children of Israel than are the grapes of this section of the country to our less favored brethren of the snowy east."

In some portions of Eastern Oregon grapes may be raised to perfection. This applies particularly to all the varieties which they raise in California, such as the Muscat, Tokay, Rose of Peru, Sweetwater and many other varieties of table grapes. But the great trouble we have is that the fruit-growers do not understand the treatment of their grapes. No other variety of fruit is so difficult to raise as the grape, since every variety must have a different method of trimming, and some doing better on the low ground, while others thrive to greater advantage if they have high ground; and when a person has to learn these things at first by actual experience, it sometimes proves quite expensive; but, as a general rule, most all the grapes in this section do the best on low ground. They are also protected from the severe cold weather in the winter thereby.

The variety we raise the most of here is the table grape. There are no regular wine grapes grown in this section, but one man, Mr. Joseph Stadelman, made about 400 gallons of wine last year from Muscats and Rose of Peru, which proved to be a very good table wine, but, of course, not what could be considered as a fine wine. The time is not far distant, however, when wine grapes, grown for commercial purposes, will be introduced here. The variety of table grapes that do the best with us now for early summer use is the Sweetwater. Other varieties, such as the Rose of Peru, Chaselas, Tokay and Muscat, are raised here for commercial purposes to a very large extent.

EMILE SCHANNO,
Commissioner, fourth district.

REPORT OF THE COMMISSIONER

FIFTH DISTRICT.

To the honorable state board of horticulture —

GENTLEMEN: I respectfully submit to you herewith my first biennial report as commissioner of the fifth district, which comprises the counties of Umatilla, Union, Wallowa, Baker, Malheur, Grant and Harney. I attempt to give a good and true report of the horticultural condition of the counties above named, it being no small task when we take into consideration the diversified locations, climate, altitudes and soils. Should there be any locality underrated or exaggerated, it will not be intentional. For one to give a perfect description of a so diversified field he must have a large acquaintance with each county and each locality in that county. If Eastern Oregon were one long stretch of country, like the Willamette valley, perhaps the task would not be so great. There are a great many questions to be discussed which are of vital importance, not only to the fruit-grower, but to the state at large as well. I shall not attempt to enlarge upon these questions, as I know they have been discussed by older members of the board of horticulture, and shall bring my mind to the more simple facts of the work. I shall begin with my home county, Umatilla. Taking up the work in the spring of 1895, at the time when the law went into effect, but very little could be expected to be done that year, for the people were ignorant of the new law, which did not go into effect until May 4, 1895. At this date the time for effective work had passed and but very little could be done only in an educational way of pruning and spraying. Several parties in the vicinity of Milton prepared at once for work, and, where the work was well done, it had its telling effect upon this season, 1896. One particular case is impressed upon my mind, that of Mr. J. Overturf, who has a small prune orchard of large trees that were completely covered with scale. Mr. Overturf, being of a very energetic disposition, sprayed with lime, sulphur and salt, as given in formula by the board.

The wash was put on as hot as could be handled. The trees were thoroughly drenched, and, upon examination during the summer, I could find no live scale this (1896) season. I find the work has been a decided success. The trees have taken on a new appearance, and the discolorations in the bark disappearing rapidly. I think Mr. Overturf has done the best work that has come under my notice. I take this to be evidence that the dreaded San Jose scale can be thoroughly eradicated. The San Jose scale was introduced into Umatilla county by Mr. Winters upon a few pear trees shipped in from California. It was introduced into Milton on oranges and lemons, also shipped from California.

Let me quote right here from C. F. Bennet, secretary of the board of horticulture of Kern county, California, under date of September 29, 1893: "We have caused all infected places to be sprayed with lime, sulphur and salt, and find that when applied thoroughly this remedy has proved very effective. But it is impossible for the board to make a clean sweep of the pests without the co-operation of all persons having infected places, as they can comply with the law and still breed scale, for, by not doing the spraying thoroughly, they do not kill all the scale and their eggs. The commissioners cannot eradicate the pests, except with the help of the parties interested, and the continual vigilance of the state board."

This gentleman has spoken my mind exactly. I hope anyone reading the above will note the facts brought out, and will co-operate with the board. If this be done there will be but little trouble. The scale had gained quite a hold upon the entire Walla Walla valley, with but few exceptions, before it was noticed. But I do not dread the pest half as much as I do the man who has not interest enough in his own welfare to spend a few dollars in heroic treatment of the pest. What one man can do is positive proof that all can meet with as good results. Our fruit industry is in jeopardy, not only from this pest, but from other things which, I deem, should be more dreaded, such as fungus diseases and codlin moth. Should the bars be thrown down, and no protection offered to the industry, many thousands of dollars would be cut off as a revenue to the state. The state has seen fit to give its aid to the industry, and there is no other industry that the state can better afford to foster. Upon this day, the ninth day of October, I viewed some large pear trees of Mr. Overturf's, before mentioned, that were quite badly infested with scale last spring, and after having had several applications of

lime, sulphur and salt I find no scale upon them. This is additional proof that the above solution cannot be excelled for the pest. The preparing of the materials is not fully understood only by a few. Perhaps right here we had better give our *modus operandi* of preparing it: First, it is necessary to have everything ready and in good working order. The boiling vat should be sufficiently large, and have as much heating surface on the bottom as possible. The vat should be placed over a good brick furnace. Some dig a trench in the ground and set the vat over it. I do not like this method, as you cannot get as intense heat as with a brick or stone furnace. There should be a fire grate in the furnace to form an ash pit, and also to keep the fire off the ground. At one end should be erected a six or eight-inch pipe for a flue; this done, we want some good, unslacked lime, good sulphur and salt, and plenty of water handy. All these things are now ready, and at this juncture have a fire started in the furnace; throw two or three pails of water into the vat; throw in one barrel of lime, and spread from end to end; then take one sack of sulphur, spread over the lime. If the lime is of a good quality it will begin to slack by this time; when it is thoroughly slacked, enough water must be added to make this very thin. This can be done gradually, so as not to cool down the boiling too much. The heat from the lime is much more intense than that from boiling water, and it is this heat that dissolves the sulphur. The most important point is to get the sulphur thoroughly incorporated with the lime; when this is properly done, and the solution properly put on, we have a solution that will kill the scale every time. The salt should be added after five or six hours of hard boiling. The boiling should be kept up continuously; then take about 20 pounds of unslacked lime and slack it in a separate vessel, and dissolve salt in it and add to the quantity in the vat; boil one hour longer.

This is a lesson all must learn to have success in spraying with this mixture. The application should be made with a strong pump, kept under as heavy a pressure as possible, so that when the solution goes on the trees the liquid is broken up into a fine spray and blown into the bark of the tree, the harder the better. This is what I call thorough treatment. To spray without this there is but little accomplished.

The codlin moth or apple worm is another pest we have to contend with. This requires much diligence, and very little can be done without the co-operation of the people. We have

found that a great deal of trouble arises from the neglect of studying the bulletins placed in the hands of the public for that purpose. Parties I am acquainted with have sprayed for moth in the winter time, and some have been found using lime, sulphur and salt as well. Their solution might as well be poured upon the ground, for it will accomplish just as much there as on trees. There are three things that should be in the mind continually—*first*, what disease or pest is to be fought; *second*, the time to make the application; and, *third*, the kind of solution to be applied. If all would bear in mind these three things and work accordingly, the work would be comparatively easy and much trouble avoided. We would soon see many pests rapidly disappearing. It seems what is greatly needed is to educate the people up to this, and this will take much time and patience. When a man is ignorant concerning the work and hardly knows how to begin, the dread of the work is much greater than the actual work itself, as I can speak from experience. I could give many instances how I have found many commencing and working; but I will suffice it by saying that nine out of ten of the new beginners will make some mistake and the results are not what is expected, and fault is found with the commissioner or the board, and will say that the board are no better posted than they; hence, the importance of horticultural education. I do not speak of these things to discourage anyone, but to show the condition of things. Then, again, we have another class of people—those who are noted for their wisdom—and this is all right if it is of the right kind; we would not be understood as speaking disrespectfully of anyone. After giving them a bulletin containing all the formulas needed for all diseases or pests, they change certain formulas, add to or take from; because they met with poor results they are sure to blame someone else. The majority are willing to go according to instructions given. I find all those who have given the subject thought and good work are paid in dollars where it only cost dimes. We are also troubled with green aphis and but very little with woolly aphis; the latter I do not apprehend will ever trouble us much, as our climate is too dry and hot; we also have some fungus diseases. I have been treating some of these trees this season and find a great difference in my fruit. I have used bordeaux mixture freely and believe this to be the only and true remedy for such diseases. Great care must be exercised as to the proper time to apply it. We also have apple canker in a few orchards. Professor Hedrick

tells me that he does not think it possible for Eastern Oregon to be troubled with it to any great extent, as our climate is not suited to its spread.

The possibilities of Eastern Oregon are great, and would speak of that part of Umatilla county known as Milton precinct, or the Walla Walla valley. Wherever we have made fruit exhibits and came in competition with other counties of the state we have been second to none. This we can say of the whole northwest, where we have come in competition with them. I know of no deciduous fruits which we cannot mature perfectly. The varieties of apples that do well here are almost numberless, and had we been strictly in the world's fair exhibit, Eagle valley would not have carried off the laurels over the big apple that measured sixteen and one fourth inches, as we have grown many here that measure over that. One placed on exhibition at our Milton fruit fair in 1895 measured seventeen and one fourth inches. The variety was the Wolf river apple. This many can vouch for. I do not recommend this as a good apple, although it will grow very large and mature nicely; it is a poor keeper, but an excellent drying or apple butter maker.

The Milton fruit district is widely known over the entire northwest; will say further for this valley, there are many thousands of acres of land lying idle and waiting for the progressive and intelligent orchardist. Taking the entire valley into consideration, the water supply is quite limited. Nature has made great provision for us. On the eastern border of the valley we have the beautiful Blue mountains in whose canyons and peaks snow lies until the first of July, furnishing large quantities of water for irrigation purposes. We might add that milling of all kinds can be done also. These waters come to us by the north and south forks of the famous Walla Walla river. Here nature has again furnished us great future possibilities in the way of forming large lakes or reservoirs for storing the water running to waste in fruit seasons of each year. Had California and many others of the western states these advantages they would be quickly taken. No long and expensive canals to be made, for nature has provided a great canal in the Walla Walla river that brings the sparkling water to our doors. We look from time to time when our capital and enterprise will take hold of this work. In this age of engineering and science, wonders can be accomplished here in the great Walla Walla valley. In the returning of prosperous times we look for great developments, not only

in the growing and shipping of green fruits, but in the canning and drying establishments. We need jelly, apple butter and cider factories; also, the sugar beet business should not be lost sight of. In many parts of the valley great opportunities are offered in the way of dairying. The valley can boast of many large, ice-cold springs.

The rich soils produce heavy crops of grasses, as well as root crops, that grow to perfection. We are met many times with the argument that we produce more than we can sell and thus cause glutting of our markets. This is true only in this sense of the word. We are now growing kinds and varieties that in an early day were considered good home market fruits. But as we have come into competition with many other little valleys of other adjoining states as well as our own, we are forced away from home with our products, and find ourselves cumbered with too many different varieties, as well as poor varieties and poor quality coming from pest-ridden orchards. To the homeseeker this may seem like a very frank statement, and one will naturally be careful where they go. You may go from the Pacific to the Atlantic, and anywhere they will find that eternal vigilance is the price of good fruit. What is needed is already being done; to clean up old orchards, weed out poor varieties and replace with standard varieties. We are not raising a tithe of what one should and could raise and dispose of, if we had large commercial orchards of the proper varieties. If we had varieties, they could be counted by the thousands of acres; these orchards would invite large wholesale dealers to come to us and purchase the fruit on the tree, or boxed, or free on board of cars, as they do in California or Florida with the orange crops, or other states containing large commercial orchards. We should have trainloads going out of the valley. When we can do this, we can make demands of our transportation companies and they will hear us; as it is, we cannot make them a proposition of any kind. We have the world for a market, and the best is none too good. When we come to realize these facts, we will not be troubled with glutted markets or over-production. Over-production, when there are thousands of families who hardly ever have fruit upon the table?

I touch upon this subject for the encouragement of producing better qualities of everything and in large quantities, thus lessening the cost of production and handling. These argu-

ments will fit and I apply them to other counties in my district, of which I will speak later on.

The district of Milton is not the only section that produces fruit in Umatilla county. There are none, though, that are equal to this particular section. We have recently found that we can mature the flaming Tokay, Muscat of Alexandria, and Mucatel grapes of California. I have later learned of a section of the county, known as the Wild Horse, lying between Weston and the Umatilla river. There are some large, fine young orchards in that place, and I am told that they are in very good shape, except some codlin moth. They grow good trees without irrigation. I shall visit that country as soon as possible.

I have, during the summer, visited the orchards from Pendleton down the river as far as the Columbia, and find in and below Pendleton many nice young orchards and in a very good condition. There are quite a number of old orchards that need attention; yes, thorough renovation, and some are in such a dilapidated condition that I have advised their entire destruction — it is hardly possible that they can be sufficiently recovered to pay expenses — the owners having heartily agreed with me. During my recent trip with Professor Hedrick, I discovered a small orchard in the city of Pendleton that has the San Jose scale very bad. This orchard, the owner tells me, he has sprayed several times and to no avail, but complains of no one for not accomplishing the destruction of the scale. I have agreed to be on hand and superintend the clearing up of this orchard after the leaves have fallen. We found a little apple canker on some young trees, but the trees seemed to be throwing it off to some extent.

About 18 miles below Pendleton, on the ranch of Mr. John Temple, I found him growing successfully the soft-shelled almond. I visited Butter Creek three times, and found several very nice orchards; especially would I speak of the orchards of Messrs. Henry Thompson and O. F. Thompson. Henry Thompson has more of an equally mixed variety than his brother and grows very excellent fruit. O. F. Thompson had last year, after drying, 18,000 pounds of Italian prunes. This year his crop is quite light. Next year he contemplates visiting some of the larger driers west of the Cascades for the purpose of obtaining the best system possible and will build accordingly. This I would recommend strongly to those now growing prune orchards, that will, in a year or two more,

yield large crops of fruit. It is a repeated mistake of many to wait until they get a large crop of fruit on hand, then begin to build and experiment in a haphazard way. It takes them two or three years to find out by dear experience what they want. If they had spent a few dollars beforehand, visiting those who had made a success of driers, they could stand out very successfully and save money and keep from throwing a poor product upon the market, which influence is hard to overcome in after years. This subject is one of extreme importance and should be pressed upon the people strongly. Mr. J. P. McMinn, of Milton, remodeled his drier this year into the Vancouver type, and has had a very successful run on Italians, and finished up with a very fine quality of both Petite and Italians. Those living near I would urge to visit Mr. McMinn and he will gladly inform them as to what they wish to know concerning his experience. I should like to enter more into details of the industry of this county but perhaps sufficient has been given.

WALLOWA COUNTY.

Wallowa county is the extreme northeastern county of the state, with but little development in the fruit industry, yet there are some very nice orchards, some of which have been set out for fifteen years. In favored localities the apple does very well, also Italian prunes and plums. Peaches do not do very well on account of the high altitude, frosts and cold winters. In the Imnaha valley the peach thrives very well, what orchards there are being quite free from all diseases except green aphis, and that is not very bad. Many of the people of this county, especially the western portion, are like those of Union county, having no faith in the county as a fruit country. I don't believe the county can be made a first-class fruit country, except in favored spots, such as along the foothills, but much can be done, more than is being done. They can raise all the country around can consume. I do not think that the county could make fruit-raising pay, as there is only one road out of the valley, and that by the way of Elgin. This makes a very long haul over rough roads, whenever we arrive at the Imnaha valley, that is situated in the extreme eastern part of the county. The river of this valley flows into the Snake river. They have the Snake river climate. This valley is very limited with fruit land, it being very narrow and very deep, drawing in at places. Some places are so

narrow that there is only room for a wagon road to be built. They have but little winter here and long, dry summers. Here the peach, nectarine and pitted fruits and all small fruits grow in profusion. Nearly every family have a small orchard and some have very nice ones, too. The market for this part of the valley is the upper portion of the county, Joseph, Enterprise and, last, Paria and the Paradise country. We must speak of one Mr. Stubblefield, living in the lower part of the valley, where a wagon has never gone yet. This gentleman has a typical orchard, in fact, the smoothest and cleanest I have visited in any part of the state. He told me that last season he packed out on packhorses 20,000 pounds of green fruit eight miles to the top of the mountains, where he could load it into a wagon and haul it to Enterprise, a distance of forty-five miles. The people are prosperous and happy; shut out from the world, as we might say, it being eighty-five miles to their nearest railroad. They do not complain of hard times as much as those of us who live with everything at our command. A few orchards showed some signs of fungi. They are all very anxious to co-operate with us. These fields make it long and hard drives to reach and consume much time, yet we feel that these places should be sought out and an eye kept on them. They all seem anxious for all the bulletins that the state board of horticulture issue. It encourages them greatly to know that they are not entirely forgotten. In some places they have a little woolly aphis, imported there on nursery stock, but they seem to have it in control. The best and most effective remedy is that of thoroughly flooding the orchard, especially around the trees. Mr. Stubblefield has practiced this, and when I visited his orchard this summer I could only find traces of them.

UNION COUNTY.

Passing from Umatilla county, we go to Union county—it is situated on the east—and find ourselves in the beautiful valley of the Grand Ronde. This valley is properly 30 miles long and 15 miles wide, giving us many thousands of acres of very fine fruit lands. These lands best adapted to fruit-raising are confined to the very slopes of the Blue mountains, except where we enter Union City, which is bottom land. Still we find many flourishing orchards through the center of the valley, known as Sandridge. This, I believe, to be more adapted to agriculture than to horticulture. There are a few

oldtime orchards scattered throughout the valley, and it has been considered that Grand Ronde valley was not adapted to fruit-raising, but many are changing their minds and having demonstrated to them that this valley is a first-class fruit section. These developments are being made by more daring dispositions, who have lately come into the valley, than by old settlers. A man's faith in a thing is shown by his works. There are hundreds of acres being set out every year to good commercial varieties, and the apple seems to be the leading fruit, although Italian prunes are a success, as well as all kinds of plums. Cherries do very well, but the valley does not claim but little for peaches. They are raised only in secluded spots, such as the cove, which is a veritable little paradise; here the peach does well. Many of the old wheat ranches are being turned into thrifty, growing orchards, that compare well with any other section of Eastern Oregon. We find some very enterprising men around La Grande, of whom the county may be proud. Many of the old settlers have stood aloof and talked discouragement. These gentlemen will in a very brief time demonstrate to the faithless the adaptability of Grand Ronde valley as a first-class fruit country. Irrigation is practiced but little, and that most for the small fruits. After an orchard has been established and firmly rooted, irrigation can safely be dispensed with by adopting a thorough system of cultivation. We find many nice orchards planted where the tall pine trees used to stand, at the foot of the mountains. From La Grande to Summerville, a distance of 16 miles along the base of the mountains, are thousands of acres of the finest apple land waiting for the enterprising orchardist.

We come to Summerville, and here we have demonstrated to us by Mr. Rhinehart and Mr. Oliver that they can raise fine, healthy looking trees. Mr. Rhinehart has 65 acres of very fine young trees. I have never seen more thrifty growing Italian prune trees. We pass here to Union and find many thousands of trees annually being planted. I would especially speak of Messrs. Tounley and Gale, and of Mr. T. Wright, who are growing very fine commercial orchards; others are following suit with smaller ones. The cove is in the northeastern part of the valley. I find here about the same condition of things. As to diseases of the valley, they are comparatively free from them. There is some codlin moth, some green aphis, and also fungus and apple canker. I have found quite a number of young trees in different parts of the valley affected with apple canker; many of them are

apparently throwing off the disease; by a little attention and proper working with them it can be entirely eradicated. I have visited orchards thought to be infested with San Jose scale, but I failed to find any or the least trace of any, but, after all, we find the orchards so clean here it is no sign we should have the people understand that they have nothing to do in the pest line. It is much easier to keep an orchard clean and thrifty than to wait until the whole valley is overrun with pests, fungus and other diseases. I believe that with a little care and the use of plenty of blue vitriol that this fungus can be kept at bay. The strong washes we are now using are great fertilizers; the man who will properly use them will be amply paid in the extra growth of his trees. This is the testimony of old, experienced orchardists. The altitude of this valley is about 2,600 feet. Hight valley lies east of Union, and as I have not yet visited this valley, for lack of time, I am told many orchards are to be found there.

We pass from Union, over the mountains again to Eagle valley, a distance of 45 miles; here we find a beautiful place. It is a very small, fertile valley, belonging to Union county, about 5 miles by 7 miles, running to Snake river. This is the valley that captured so many diplomas for choice fruit at the world's fair. I counted 14 of these diplomas. The apple that measured 16¼ inches beat the world at that time. These people are very proud of this; they have the identical bantam rooster to still crow for them that crowed for so many thousands of people who viewed Oregon's largest apple that beat all for size. This is another little valley that has poor advantages for shipping her fruit, Baker City being their nearest railroad station, and it is 45 miles distant. There are a great many mining camps that take great quantities of fruit as well as vegetables. Eagle valley has a little over 200 acres of orchard; in this valley they are in danger of becoming pest ridden, as the seeds are already sown. Upon my visit to them I saw signs of codlin moth and fungus diseases. On one orchard we found the San Jose scale had a good start; but, in general, their orchards were looking very well. Pine valley lies north of Eagle valley 10 miles; they have here about the same number of acres as in the Imnaha valley. I could not stay long enough in June to get full count of the number of acres on account of high water. I do not think this valley so well adapted to fruit-raising as Eagle valley. Next year I intend to go back and stay long enough to get the total acreage here and make a close inspection. I passed to Snake river,

but could do very little on account of high water, which covered the roads in many places, and on account of these difficulties I had to make my visit here very short. There are quite a number of young orchards being set out along Snake river about 15 miles below Huntington. The Cook ranch has quite a large peach orchard, and is growing some of the largest and finest peaches I ever saw. I could not stay long enough to determine fully what diseases are here, and at this time, to give a description and possibilities of this country, I can do no better than give here a letter received from Mr. B. A. Bowman in answer to some questions I wrote him for information for this report, not feeling myself able to make an intelligent report of this country :—

BAKER CITY, Oregon, October 10, 1896.

G. W. Hobbs, Esq., state board of horticulture, Freewater, Or.—

DEAR SIR: Upon my return from the ranch I find your favor of the first, and note contents. I have been so much occupied in this fruit trade since my return that you will please pardon me for not answering your inquiries more promptly. Referring to your inquiries as regards the possibilities of Eastern Oregon as an "assiduous fruit-producing section," I would say that should I go into the matter in detail, I fear that I might weary your patience before the subject would be exhausted; therefore, I will answer your inquiries as briefly as possible. I think that in many sections of Eastern Oregon, especially along the Snake river and adjacent streams, where irrigation can work in harmony with the soils and climate, that there are seldom found so perfect a combination for the production of these goods as are found in Eastern Oregon. There are three forces which seem to unite and work in harmony in these sections, and work nearly to perfection. Hence, the perfect result; these forces are proper mineral deposits, proper climatic conditions and moisture under control, by the way of irrigation. These forces when properly united are controlled, and controlled only by way of irrigation. Proper moisture at the proper time is the chief essential to tree growth and fruit maturity. To a person who understands this combination, it is just as easy to make a fruit-bearing tree produce the desired result as it is for a locomotive engineer to produce his desired results with his engine; he pulls the throttle and the power is on and usually under his control. The fruit-producer hoists the gate

and his power is on and under his control. Now, if they are each mechanics, there must be proper results. Fruit-culture cannot be done to perfection in a haphazard way. There seems to be no end to the demand for the best fruits — choice fruit is attractive to the sight. The sight demands that the taste should take notice; the appetite is aroused and demands consumption. These senses combine and make the demand and call for more production, and the higher the grade the more "sight" makes her demands, and the greater the price of the product. I venture to state that Eastern Oregon has thousands of acres of the best lands in the world under the most perfect conditions for the production of these fruits, and I venture further to say that if the wine-growers of France and Germany understand the perfection of this natural combination, and what can be done in fruit-culture in and around the mentioned sections of Eastern Oregon, these lands would be very valuable. I would like to have the people of any part of this country, or the old world, or any part of it, look in and see the different kinds of grapes, pears, apples or any of the "assiduous fruits" that have been and now are on exhibition and for sale in my store in this city; and especially would I ask any of the California fruit-producers to compare these grapes, pears or apples or peaches,— all produced and for sale daily in Baker county, Oregon,— and if they produce anything more sightly, or, if they will produce equal in quality, I will admit that it is something that has heretofore escaped my observation; they can trot out their great grapes — the flaming Tokay or the purple Tokay or their black Dehisa, their Muscat or Muscatel, Rose of Peru,— and the east can produce their Delaware, Concord and some other varieties, and we will see them and go them one better, both in style and flavor. I mean, we will do this on a business, everyday basis. With Bartlett pears and apples California would not pretend to be in it at all, and you know about where they would be with us on peaches, as I think you saw samples when here this summer. Pardon the length of this reply to your brief inquiry, but there is so much to say on this subject that I do not always know where to draw the line when I once get started.

Respectfully yours, A. B. BOWMAN.

Burnt river, in Baker county, has a few orchards in comparatively good condition, except for codlin moth; that is prevalent everywhere. On Chicken creek, three miles from

Weatherly, I found one orchardist growing the almond and English walnut, the walnuts not having fruited yet. The part of Baker county growing fruit is about forty miles long —Burnt river and Snake river, with a number of small creeks leading into Snake river.

MALHEUR COUNTY.

Malheur county I have not yet visited, as it is a long, hard drive to reach the part where orcharding is practiced. However, I have been informed the industry is in its infancy. It is my intention to visit these parts next year, if possible.

GRANT COUNTY.

Grant county I did not visit till this last September. There is but little fruit raised in this county — all told, 100 acres. One 40-acre apple orchard was set out 24 years ago by Mr. Rhinehart, who lives 3 miles from Canyon City. This orchard will have this year a very small crop — only about 6,000 boxes. His apples are entirely free from worms. A few pear trees are showing some crater-blight and slight fungus in other trees.

HARNEY COUNTY.

Harney county raises no fruit at all, but gets her supply from John Day valley.

Nurseries.—There are only four nurseries in all of Eastern Oregon — two at Milton and two in the Grande Ronde valley. These I have carefully inspected, and will say a more healthy and clean-looking stock cannot be found anywhere in the state. I have, during this last summer, visited a little over 400 orchards, and, in general, find them quite free from pests. There is but little scale, and most of that at Milton. The codlin moth is plentiful in all localities. I have found that the months of September and October are the best in which to detect scale, as it will show on the fruit when the trees are dormant. As times are hard and work is scarce there are many who resort to peddling, and this is when much of the pests and diseases are scattered. This carelessness should be followed up very closely and the law administered sharply. But, for lack of funds to work from early spring to late in fall, much work is not as effective as it otherwise would be; notwithstanding, a great amount of good has been done,

and there is a waking up all along the line. Old children are hard to mind, and I cannot liken the work to anything but a man with a large family of spoiled boys. Tell them to do anything and you have to follow them up to see if they do it.

In conclusion, I would say I am encouraged with the work that has been done, and, again, I will say there is no work or industry that the state can better afford to foster.

Respectfully submitted,

GEORGE A. HOBBS,
Commissioner, fifth district.

SUPPLEMENTARY REPORT.

To the honorable state board of horticulture—

GENTLEMEN: I respectfully submit to you herewith my second biennial report as commissioner of the fifth district.

On the twenty-sixth of November, 1898, I left home for the extreme eastern part of my district, Grande Ronde, Eagle and Pine valleys. I had been appealed to a number of times by Eagle valley people to visit them this fall, and accompanying one letter was an apple branch literally covered with scale, asking me what it was.

Two years ago last September I traced the scale to one orchard only, and that very light, and had the parties followed out my instructions, on bulletin No. 9, much trouble and cost would have been saved to many, whereas, as this visit proved, the scale had developed very rapidly in many other orchards.

Eagle valley is noted for its excellent fruits, both in texture and flavor, and with this people, as with others, a spirit of indifference to pests has been maintained, and now they are waking up to find themselves in a dilemma and are now very willing to co-operate with the board to exterminate these pests. Since my last visit the codlin moth has put in its appearance. This is to be regretted very much.

Pine valley, at a distance of ten miles from Eagle valley, as near as I could find in a short visit, is entirely free from these pests, but how long it will remain so is a question.

As these valleys and others have been noticed for their adaptability for fruit-raising, we will not repeat what we have

formerly written of these places, except to mention a recent letter I received from Mr. W. R. Usher, who, through his enterprise and untiring energy in the fruit industry, sent fruit exhibits to the late Omaha exposition, and writes me that he has been awarded a diploma and silver medal, and considers himself well paid for all trouble and annoyances.

Pine valley has not developed the fruit industry to the extent of Eagle valley, as here the advantages for marketing are limited, but her resources are hardly known. The altitude is nearly 3,000 feet. Apples and pears grow to perfection. The people are planting out young orchards quite extensively, and will soon be able to export quite largely. I find the soils are peculiarly adapted to pears and apples, having all the mineral deposits necessary for making good tree growth, and producing as fine fruit as can well be found in any part of Oregon. I am told they supply their home demand and furnish much to the many mining camps.

Eagle valley is an older valley in the industry and better situated to get her products to the markets. These valleys are very small — 3 miles by 7 will take in about all the available fruit land of Eagle, except running up a mile or two on the little creeks which are tributary to the Eagle river proper.

I will now give you a few statistics as to Eagle's products and what they have or will dispose of for this season : Apples, 15,000 boxes; pears, 50,000 pounds; apricots, 3,000 boxes; plums, 15,000 pounds; peaches, 15,000 pounds; prunes, 50,000 pounds; blackberries, 100,000 quarts.

As this is a wonderful valley for alfalfa, I find there are 1,400 stands of bees. A number are making the industry a specialty, and out of this number there are 1,000 working stands, and I am told by the best authority there that 120 pounds to the stand is considered a summer's work. This would make 120,000 pounds of marketable honey. This honey was inquired of as far as the St. Louis, Missouri, market.

The market prices received for the above mentioned products of Eagle valley alone, amount, in round numbers, to $41,000. This amount seems almost incredible when one stands upon the high hills which surround this little garden valley and views the small area, but the half has not been told. I wish I could give in tons the amount of alfalfa that is produced here. It is enormous; and here is where many thousands of beef cattle are fattened for the market. This industry, alone, runs into high figures.

Now, then, we have given you a conservative figure as to

amounts and money received for the fruit business, and you will please bear in mind that all of Eagle valley products are first class in every respect. As you will see by my first report, I actually counted up 14 awards and medals awarded by the Columbian exposition held in Chicago, as well as the recent award at the Omaha exposition. And it is deplorable to see the increase which pests are making here. This all has come about by your commissioner not being able to carry on the work the last two seasons, simply through the lack of proper funds for the work. But from now on, if we can have a reasonable amount to work with, we can head off or completely exterminate these pests; and is not the industry worth it?

We cannot report particularly from Snake river, more than what has previously been said, only from reports, they are very much annoyed with the appleworm. The same is applicable to Burnt river, from Huntington to Baker City.

Malheur county I have not been able to visit yet. I am told that at Ontario they have many very fine young orchards just coming into bearing, and as soon as the spring weather of 1899 will permit me, I shall enter this part of the field, and take every precaution to prevent the spread to this section of these fruit pests which are of so much annoyance to the orchardists.

The few short days I was in the Grande Ronde valley I gathered some data in regard to her fruit industry. I cannot find any traces of the San Jose scale in this valley, and it is a wonder that it has been kept out; but I find the codlin moth is increasing very rapidly here. At the cove, I am told, not over one fourth of the crop of apples was saved free and clean.

Heretofore I have, as near as possible, given to every orchardist bulletin No. 9, which, if carefully read and practiced, would put a man in such shape as he could save at least 90 to 95 per cent. clean fruit. Yet, when I meet these very same people, they say to me, "What are we going to do?" All I can say to them is, go out of the business, or go to work and co-operate with us.

The Grande Ronde valley has exported up to date, November 20, 1898, the following: Seventeen cars of fresh prunes, 50 cars of apples, 4 cars of mixed fruits, 4 cars of dried apples and 4 cars of dried prunes. Mr. Allen has, at the cove, erected one of his patent driers for Kansas City parties, the capacity of which is 48,000 pounds of green prunes every 30

hours, and will not be able to handle over one half of the prune crop. One hundred tons will be dried.

A distillery has also been established at the cove, which will work up into spirits 150 tons of apples.

Mr. Hice, from Kansas City, has built an apple drier at La Grande that will dry 50 tons. Mr. Hice bought up whole orchards, sorted and shipped all No. 1 stock, and culls will go into dried apples and chops.

One thing very noticeable in Grand Ronde valley is the rapid increase in acreage of apple orchards, all of winter varieties. This valley, in a few short years, will be exporting hundreds of cars of the best varieties of winter fruit. And I want to seriously impress on the minds of all these people that inattention to orchard pests is simply a strong invitation for them to come. Now is the time for you to post yourselves as to the nature of the pests and diseases and their remedies. Be vigilant as you would with a foe; prepare yourselves beforehand, for you surely will regret it if you do not.

Umatilla county must not be forgotten as she is the oldest fruit-raising county in Eastern Oregon of any note.

I will say of the San Jose scale that it is not increasing, but about holds its own. Nearly every orchardist has been fighting this pest and where good, thorough work has been done clean orchards are the result. But we have some who are not so determined as others and the pest has gained on them. Of course you will remind yourself that no field work has been done for two years by your commissioner, for reasons already cited. The fifth district is very large in area and causes a great deal of traveling to reach all valleys and fruit sections. I have figured out a round trip in miles which cannot be made in less than 600 miles of travel. This consumes much time and money. When we dropped the work two years ago and in the two previous years we had gotten the work under very good way and began to see rapid improvements in many ways, but, forced to drop the work, we shall have to go over about the same ground again, but we are confident we are much better prepared to take up the work again and the majority are now acknowledging that it is simply a business proposition and are willing to co-operate with the board, as it begins to touch their pocketbooks heavily. Giving a conservative estimate, I would say not over one fourth of our apple crop here in Umatilla county was free from worms, and I believe I have been in some orchards this fall where there

were from 1,000 to 1,500 bushels of apples of which not two per cent. were clean and all on the ground at that.

Following are our export shipments, as close as I can get together figures: We have shipped from the county: Seventy-five cars of winter apples, 20 cars of dried prunes, 3 cars of green prunes, 20 cars of green prunes (went to Walla Walla to be dried), 10 cars of pears, 6 cars of strawberries, 4 cars of blackberries and 3 cars of peaches. At least one half of our Milton fruits are sold to Walla Walla buyers, are shipped from there and go out branded "Walla Walla fruit." Taking Umatilla river and Butter creek, with other small places, at least 50 to 75 cars have been thrown on the home markets.

This report is not as complete and satisfactory as I would like it to be, but, as it is, I believe I have given conservative figures. Our work is assuming such proportions that a commissioner should be in the field nine months steady; at least, this is the case in district No. 5, and more money is needed to carry on the work; and there is no money spent in any industry which will revert back more quickly than that which is spent judiciously in orchard work.

In conclusion, I can only say or repeat what I have said in my first report: "I am encouraged with the work that has been done, and again I will say there is no work or industry that the state can better afford to foster."

Respectfully submitted, G. A. HOBBS,
Commissioner, fifth district.

PREPARATION OF SPRAYS.

SPRAY NO. 1.

Ingredients—Lime (unslacked), 50 pounds.
Sulphur, 50 pounds.
Stock salt, 50 pounds.

This will make 150 gallons of wash.

Directions.—Slack 50 pounds of lime, then add the 50 pounds of sulphur, boil it over a brisk fire for one hour, then place all the salt with it in the boiler and boil for 15 minutes more, then add the necessary amount of water to make 150 gallons. This solution should be used at a temperature of at least 100 degrees. Before using, strain it. The utility of this wash depends a great deal upon the strength of the sulphur. It is, therefore, recommended that those who use this wash have a Beaumes scale for acid. When it shows 8 degrees when cold, it is of the proper strength. These scales can be obtained through any druggist at a cost not to exceed 50 cents.

This combination is the result of Mr. Emile Schanno's extensive experiments in the fourth district.

SPRAY NO. 2.

Ingredients—Sulphur, 100 pounds.
Lime, 100 pounds.
Blue vitriol, 15 pounds.

Directions.—Take 100 pounds of sulphur and put into a 40-gallon kettle. Add about four gallons of water and stir until thoroughly mixed, then add about 20 gallons of water and start your fire under the kettle. Take 100 pounds of good fresh lime and slack it in a box, keeping the lime covered with water while it is slacking. Add this slowly to the sulphur. While boiling, stir all the while to prevent burning. Boil four hours and finish about night. Dissolve 15 pounds of blue vitriol in hot water, which pour into the compound slowly. Keep boiling until it is smooth, then let it settle for about 15 minutes, after which pour into a barrel and see that you have 30 gallons and no more. Cover your barrel up

tight until morning, then open it, and as it begins to cool keep stirring to prevent a crust from forming. When cool no crust will form, and it will keep any length of time.

For use.—Take 1 gallon of the compound to 19 gallons of water. Use about 8 gallons of boiling water to the 1 gallon of the compound, making up the difference in cold water. Never spray unless the bark on the tree is dry.

SPRAY NO. 4.

RESIN WASH, BY PROFESSOR KOEBELE.

Ingredients— Resin, 4 pounds.
Sal soda, 3 pounds.

A good summer spray for San Jose scale.

Directions.— Place resin and sal soda in kettle with 3 pints of cold water. Use soft or rain water always. Boil or simmer slowly until thoroughly dissolved, when it will look black. The sal soda will adhere to the sides of the kettle, and must be scraped down. When it looks dissolved, if there are pieces of resin in the bottom of the kettle it needs more boiling. When sufficiently boiled, add enough hot water to make 50 gallons. After adding the water it will become thick, but after boiling again it becomes thin. The above is ready for immediate use and should be applied cold or only lukewarm. If desired for future use, boil the above amount of ingredients as directed, and add water to make 5 gallons; boil until thick. This will stand any length of time, and is always ready for use. When required, use one part or gallon of compound with the following number of gallons of boiling water and stir thoroughly when applying: For hop louse, 1 gallon of compound to 9 gallons of water; for woolly aphis, 1 gallon of compound to 7 gallons of water; for San Jose scale, 1 gallon of compound to 6 gallons of water. The foregoing spray is not injurious to the tree, for after three or four days of sunshine it dissolves and leaves the pores of the bark open.

SPRAY NO. 7.

BORDEAUX MIXTURE FOR FUNGI.

Ingredients—Sulphate of copper, 6 pounds.
Lime, 4 pounds.
Water, 45 gallons.

MODIFIED BORDEAUX MIXTURE.

Ingredients—Sulphate of copper, 3 pounds.
Lime, 4 pounds.
Water, 45 gallons.

LATEST ADVICES ON THE BORDEAUX MIXTURE.

The combination of bluestone and lime, known as the bordeaux mixture, is almost indispensable in fruit-growing and gardening. It is almost a sovereign remedy against injurious fungi and its use is general throughout the world. The best way to make the preparation is, consequently, a matter of the greatest moment. The division of vegetable pathology of the department of agriculture has just issued a bulletin on these lines which is very timely. It is four years since there was published, in Farmers' Bulletin No. 7, a summary of the more important methods of combating some of the destructive diseases of fruit. During this time many improvements have been made in the work, and for this and other reasons it seems desirable to now bring together, in brief, practical form, our present knowledge on the subject. The question as to whether it will pay to spray has long since been answered in the affirmative, so it is not necessary at this time to enter upon any argument in regard to this phase of the subject. It is, furthermore, not necessary to go into details as to the relation of spraying to hygiene; suffice it to say, that if the work is properly done no danger whatever to health need be apprehended.

Superiority of the bordeaux mixture.—During the past four years numerous solutions, powders, etc., have been tested, with a view of determining their value as economical, effective, and practical preventives of fungous parasites. While a number of these preparations have given promise of value, none have been found which fill so many requirements as bordeaux mixture and the ammoniacal solution of copper carbonate. Of the two preparations bordeax mixture has long been recognized as posessing the most valuable qualities, and it is probably more generally used today than all other fungicides combined. The chief points in its favor are,—(1) its thorough effectiveness as a fungicide; (2) its cheapness; (3) its safety from a hygienic standpoint; (4) its harmlessness to the sprayed plant; and (5) its beneficial effects on plants other than those resulting from the mere prevention of the attack of parasites.

Bordeaux mixture formula.—All things considered, it is believed that the best results will be obtained from the use of what is known as the fifty-gallon formula of this preparation, as follows:—

Ingredients— Water, 50 gallons.
Copper sulphate, 6 pounds.
Unslacked lime, 4 pounds.

Must be well made.—It has been found that the method of combining the ingredients has an important bearing on both the chemical composition and physical structure of the mixture. For example, if the copper sulphate is dissolved in a small quantity of water and the lime milk diluted to a limited extent only, there results when these materials are brought together, a thick mixture, having strikingly different characters from one made by pouring together weak solutions of lime and copper sulphate. It is true, furthermore, that if the copper sulphate solution and lime milk are poured together while the latter, or both, are warm, different effects are obtained than if both solutions are cool at the moment of mixing. Where the mixture has been properly made there is scarcely any settling after an hour, while the improperly made mixture has settled more than half.

How to make it.—Briefly, the best results have been obtained from the use of the bordeaux mixture made in accordance with the following directions: In a barrel, or other suitable vessel, place twenty-five gallons of water; weigh out six pounds of copper sulphate, then tie the same in a piece of coarse gunnysack and suspend it just beneath the surface of the water. By tying the bag to a stick laid across the top of the barrel no further attention will be required. In another vessel slack four pounds of lime, using care in order to obtain a smooth paste, free from grit and small lumps. To accomplish this it is best to place the lime in an ordinary water pail and add only a small quantity of water at first, say a quart or a quart and a half. When the lime begins to crack and crumble and the water to disappear add another quart or more, exercising care that the lime at no time gets too dry. Toward the last considerable water will be required, but, if added carefully and slowly, a perfectly smooth paste will be obtained, provided, of course, the lime is of good quality. When the lime is slacked add sufficient water to the paste to bring the whole up to twenty-five gallons. When the copper sulphate is entirely dissolved and the lime is cool, pour the

lime milk and copper sulphate solution slowly together into a barrel holding fifty gallons. The milk of lime should be thoroughly stirred before pouring. The method described insures good mixing, but to complete this work the barrel of liquid should receive a final stirring for at least three minutes with a broad wooden paddle.

Testing the mixture.— It is now necessary to determine whether the mixture is perfect—that is, if it will be safe to apply it to tender foliage. To accomplish this two simple tests may be used. First, insert the blade of a penknife in the mixture, allowing it to remain there for at least one minute; if metallic copper forms on the blade, or, in other words, if the polished surface of the steel assumes the color of copper plate, the mixture is unsafe and more lime must be added. If, on the other hand, the blade of the knife remains unchanged, it is safe to conclude that the mixture is as perfect as it can be made. As an additional test, however, some of the mixture may be poured into an old plate or saucer, and while held between the eyes and the light the breath should be gently blown upon the liquid for at least half a minute. If the mixture is properly made, a thin pellicle, looking like oil on water, will begin to form on the surface of the liquid. If no pellicle forms, more milk of lime should be added.

Preparing large amounts.—The foregoing directions apply to cases where small quantities of the mixture are needed for more or less immediate use. If spraying is to be done upon a large scale, it will be found much more convenient and economical in every way to prepare what is known as stock solutions of both the copper and lime. To prepare a stock solution of copper sulphate, procure a barrel holding 50 gallons; weigh out 100 pounds of copper sulphate, and, after tying it in a sack, suspend it so that it will hang as near the top of the barrel as possible; fill the barrel with water, and in two or three days the copper will be dissolved; now remove the sack and add enough water to bring the solution again up to the 50-gallon mark, previously made on the barrel. It will be understood, of course, that this second adding of water is merely to replace the space previously occupied by the sack and the crystals of copper sulphate. Each gallon of the solution thus made will contain 2 pounds of copper sulphate, and, under all ordinary conditions of temperature, there will be no material crystalization, so that the stock preparation may be kept indefinitely.

Stock lime may be prepared in much the same way as the copper sulphate solution. Procure a barrel holding 50 gallons, making a mark to indicate the 50-gallon point; weigh out 100 pounds of fresh lime, place it in the barrel and slack it; when slacked, add sufficient water to bring the whole mass up to 50 gallons. Each gallon of this preparation contains, after thorough stirring, 2 pounds of lime.

When it is desired to make bordeaux mixture of the 50-gallon formula, it is only necessary to measure out 3 gallons of the stock copper solution, and, after thorough stirring, 2 gallons of the stock lime; dilute each to 25 gallons, mix, stir, and test as already described. One test will be sufficient in this case. In other words, it will not be necessary to test each lot of bordeaux mixture made from the stock preparation, provided the first lot is perfect, and no change is made in the quantities of the material used. Special care should be taken to see that the lime milk is stirred thoroughly each time before applying. As a final precaution, it will be well to keep both the stock copper sulphate and the stock lime tightly covered.

SPRAY NO. 10.

Proportions for first application—**Paris green, 4 ounces.**
Lime, 2 pounds.
Water, 40 gallons.

Proportions for later applications—**Paris green, 4 ounces.**
Lime, 1 pound.
Water, 50 gallons.

Directions.—Slack the lime; make a paste of the paris green, mix thoroughly, and then add water to make the required amount; stir thoroughly while using, and should be thrown on the leaves and fruit in a fine spray.

Paris green is one of our commercial articles which is shamefully adulterated. The foregoing formula is based upon pure paris green; it is therefore of much importance that one be able to detect impurities. So far as we know, but two adulterants are used, gypsum and Glauber's salts. The method generally given for the detection of adulteration is to dissolve a small sample of the paris green in ammonia. If there is any gypsum it will not dissolve, but forms a sediment. Glauber's salts cannot be detected by this method, it being equally as soluble as pure paris green; but if one has a strong microscope at hand the adulterant granules can be easily detected,

they being white, while the pure article is green. Ammonia, however, is generally a good test, gypsum being most commonly used as an adulterant.

"THE ARSENITE OF SODA SPRAY."

Professor Kedzie's formulæ:—

Ingredients—Commercial white arsenic, 2 pounds.
Carbonate of soda, 4 pounds.
Water, 2 gallons.
Use 1½ pints to 50 gallons of bordeaux mixture.

Directions.—Dissolve 2 pounds of commercial white arsenic and 4 pounds of carbonate of soda (washing soda) in 2 gallons of water, and use 1½ pints to 50 gallons bordeaux mixture. The easiest way to make the solution is to put both the white arsenic and carbonate of soda in a gallon of boiling water and keep boiling about 15 minutes or until clear liquid is formed, then dilute to 2 gallons. One and one half pints of this solution should be added to each barrel of full strength bordeaux mixture for earlier sprayings and modified bordeaux mixture for late sprayings.

If used without bordeaux mixture or lime it is liable to burn the foliage. As there is nearly always fungus to contend with, it is recommended that the two sprays be combined, with the additional advantage of making the poison stick longer.

SPRAY NO. 14.

Ingredients—Tobacco (sheep dip, sulphured tobacco), 4 pounds.
Whale-oil soap (or good strong soap), 4 pounds.
Water, 20 gallons.

Directions.—Soak the tobacco in hot water for several hours; dissolve the soap in hot water; strain both ingredients; add together and dilute to 20 gallons. On varieties of trees where the foliage is very tender, tests should be made before applying extensively.

KEROSENE EMULSION (GOVERNMENT FORMULÆ.)

Ingredients—Kerosene, 2 gallons.
Water, 1 gallon.
Hard soap, ½ pound.

Directions.—Make a suds of the soap and water and pour boiling hot into the kerosene; churn with a force pump or a

syringe, pumping out of and into a bucket or barrel through a nozzle until completely emulsified. If the mixture is sufficiently hot it will thicken in from five to ten minutes, and will be, when cold, of the consistency of butter or of soft soap. Dilute with seven (7) to twelve (12) parts of water to one (1) of emulsion, as occasion requires, and this will kill almost anything in the form of plant lice. For peach lice dilute with fifteen (15) parts of water.

HYDROCYANIC ACID GAS FOR NURSERY STOCK.

Ingredients — C. P. cyanide of potassium, 98 per cent., 1 ounce.
Sulphuric acid, 1 fluid ounce.
Water, 2 fluid ounces.

Directions.— First, place the vessel in which the gas is to be generated in a convenient place in the shed, and then put in the cyanide of potassium; pour the water over the cyanide and then add the sulphuric acid very slowly. Close the door and submit the trees to the fumes for about forty minutes. Open the door and allow the gas to escape before attempting to remove the trees, as it is poisonous to inhale.

REMEDY FOR APHIS (LICE) ON CABBAGE, CAULIFLOWER, TURNIPS, ETC.

Ingredients— Quassia chips, 1 pound.
Whale-oil soap, 1 pound.
Water, 1 gallon.

Directions.— Boil quassia chips for five hours, then add whale-oil soap, while boiling; when dissolved dilute to ten gallons of water and spray warm.

RECIPE FOR GRAFTING WAX.

One of the best grafting waxes is made by melting together four parts — by weight — of resin, one part beeswax, one part tallow. When thoroughly melted pour into cold water; when cool enough, take out and work by molding and pulling until it becomes quite stiff. It is necessary to have the hands well greased with tallow while handling this wax.— *From Yearbook of the United States department of agriculture.*

SPRAY CALENDAR.

This calendar has been prepared to answer the question so often asked, what spray to use and when to spray, as well as to obviate the error to use the wrong spray for any given insect or fungi.

All fruit trees should be sprayed in the fall as soon as all the leaves have dropped with either sulphur, lime and salt, or sulphur, lime and blue vitriol; if no scale are present, full strength bordeaux mixture will be found sufficient.

FOR APPLE SCAB, PEAR SCAB AND LEAF-BLIGHT.

First application.— Just as the buds are swelling, with lime, ten pounds; blue vitriol, six pounds; water, forty-five gallons.

(Ready to spray second time).

Second application.— Just as the fruit buds break open but before the flowers expand, with lime, four pounds; blue vitriol, five pounds; water, forty-five gallons.

Third application.— With the same formulæ when the fruit has attained the size of a hazelnut.

FOR CURLLEAF ON THE PEACH.

Prof. Newton B. Pierce says: "Curlleaf of the peach is caused by a parasitic fungus which is known as *Taphrina de-*

formans. The fungus lives within the tissues of the leaf, in the tender shoots and in the buds. Within the past few months I have learned that lime, sulphur and salt is a satisfactory preventive of this widespread disease. The application of this spray should be made three to five weeks before the buds open in the spring. The treatment should be very thorough. Or spray with bordeaux mixture six weeks and again three weeks later before the buds begin to swell.

FOR CANKER OR DEADSPOT.

Cut out diseased spots clean in the fall when leaves have dropped, and wash with bordeaux mixture; repeat in midsummer, if found necessary.

FOR GUMMOSIS.

Cut out gum pockets, split the outer bark about one eighth of an inch deep from roots to branches on three sides when sap begins to flow, as all gum-infected trees are barkbound, and wash with bordeaux mixture; care must be taken in splitting the bark not to cut through to the wood; repeat in midsummer, if necessary.

FOR BLACK ROT ON GRAPE.

Spray with bordeaux mixture just as the buds are swelling and again immediately after blooming with modified bordeaux mixture.

FOR TINGIS, CATERPILLARS AND SLUGS.

Use spray No. 10 as they hatch and appear on the leaves.

FOR WOOLLY APHIS.

Kerosene emulsion diluted seven (7) times, or resin wash, as they make their appearance on the trees.

FOR GREEN APHIS.

First application with sulphur, lime and salt in the fall after leaves have dropped, followed in the spring with spray No. 14, as they appear on the trees.

FOR SAN JOSE SCALE, GREEDY SCALE AND TURTLE-BACK SCALE.

Sulphur, lime and salt in the fall as soon as the leaves have dropped and again in the spring before the buds begin to swell.

FOR PEAR-LEAF BLISTER MITE *(Phytoptus pyri)*.

Until recently the rough, brown-looking spots seen on the pear trees were passed by as being the fungus that attacks the pear so generally here, but upon closer examination it was found that these spots are the work of this mite. In some localities this pest has gained a strong foothold, and in others it is as yet hardly noticeable. The *Phytoptus pyri* is a microscopic gall mite. It cannot be seen with the naked eye, except on a piece of clear glass held up to the light, when it appears as a minute speck. It is not nearly as long as the width of a hair. It is found only on the pear, the leaves of which are exclusively its home. It burrows into the pulp of the leaves, making a cave in which it lives and multiplies. A colony will work out an excavation, which becomes a slight puff or dark-colored gall on the leaf, from a speck to an eighth of an inch in size. The mite keeps open a hole on the under side of the leaf for a doorway. The injury to the tree is caused by the leaves becoming dried and falling. This mite is supposed to desert the leaves after they have fallen, and seek winter quarters upon the tree. It would be a good plan to burn all fallen leaves from affected trees and spray the trees with No. 2 spray as soon as the leaves have dropped. In the summer the mite can be destroyed with powdered sulphur, but it cannot be expected to rid the tree entirely of the mite by this means, as there are eggs and young in the caves, which the sulphur does not affect. In California they use a seeder on a wagon for throwing the sulphur on the affected trees.

Remedy.—Sulphur, lime and salt before the buds swell, followed by dusting with sulphur when leaves have formed.

LEAF-BLIGHT OF THE STRAWBERRY.

This blight is a fungus (*Sphærella Fragariæ*), the life history of which is discussed in Bulletin XIV of this station (December, 1889). The spots showing fungus attack are brownish at first, but afterward become dry and whitish, with a circle of red; and finally the entire leaf assumes a red-spotted or red-discolored appearance. The blight does its worst mischief in

the summer, after the fruit is off, by preventing growth and lessening the crop of the following year. The disease usually begins to attack the leaves before the fruit is off, however, and in some cases even earlier. There are two methods of dealing with this disease in this state — discarding susceptible varieties, and plowing up the patch after the first crop is off. These means are very effective when they are systematically pursued. There is a general and growing tendency to fruit the strawberry patch but one year, and there are strong reasons in favor of it aside from the desire to check the blight.

It has been proved by Professor Garman, of Kentucky, and others, that this leaf-blight can be subdued by fungicides.

LEAF-BLIGHT OF THE STRAWBERRY.

Spraying with Bordeaux mixture after the fruit has been gathered, and again after 30 days with modified bordeaux mixture, has proved very successful. — *From Prof. L. H. Bailey, Cornell university agricultural experiment station.*

FOR CODLIN MOTH.

Spray number ten (10), or, "The arsenite of soda spray," when the fruit has attained the size of a hazelnut; again, three weeks later; again, three weeks later; for fall and winter apples, again last week in August, or first week in September.

FOR PRUNE AND PLUM ROT.

Spray with bordeaux mixture as the buds are swelling, and again when the fruit has attained the size of a bean, with modified bordeaux mixture.

FOR TWIG-BORER AND BUDMOTH.

Spray in the fall, as soon as all the leaves have dropped, with sulphur, lime and salt solution, followed up in the spring, as soon as the buds begin to swell, with the following wash: Sulphate of copper, 3 pounds; lime, 4 pounds; paris green, 4 ounces; water, 45 gallons; and, again, with the same wash the latter part of May.

FOR CURRANT AND GOOSEBERRY WORM.

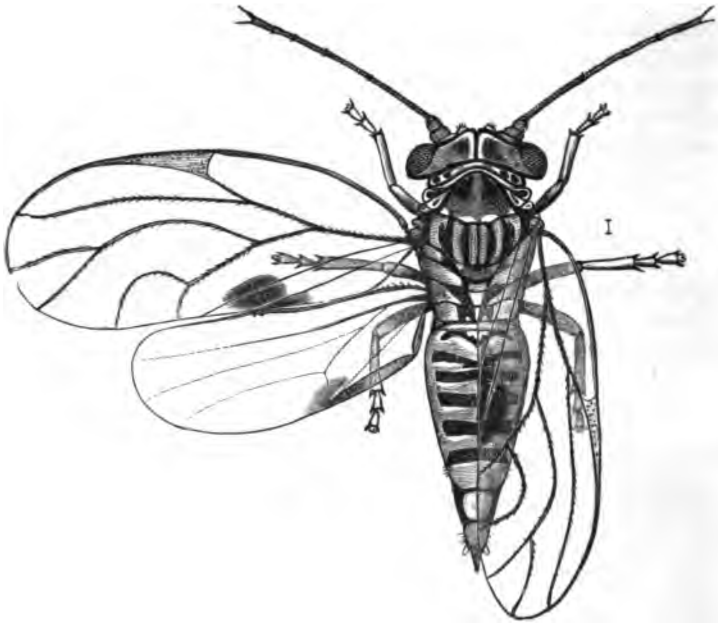
Spray the bushes just before blooming, and again after the fruit has set, with one large tablespoonful of powdered white hellebore, dissolved in two and one half gallons of water.

PEAR SCAB, CRACKING AND LEAF-BLIGHT.

These diseases, caused by two different species of fungi, are successfully combatted by one line of treatment. In most sections all three diseases are found associated. Bordeaux mixture has given the best results in this work. The first spraying for these diseases should be made just before the buds swell. In ten or twelve days the second treatment should be given, followed by a third and fourth at the expiration of two and four weeks, respectively. In the nursery, pear-leaf blight is often exceedingly troublesome. It may be almost entirely prevented by spraying five or six times with the bordeaux mixture, making the first application when the leaves are about one third grown, and the others at intervals of ten or twelve days throughout the season. The leaf-blight of the cherry, plum and quince, which so seriously affects trees, both in the orchard and nursery, may be held in check by using bordeaux mixture.

FUNGUS ON LEAF AND BRANCH OF THE PEAR.

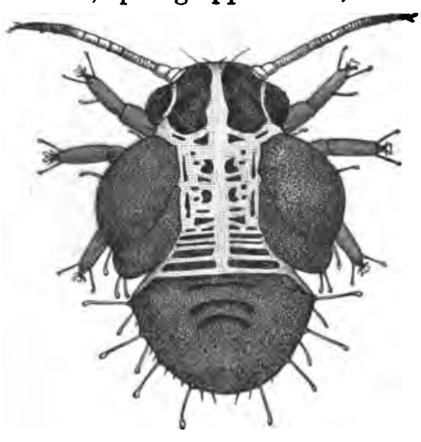
FOR PEAR-TREE PSYLLA.



PEAR-TREE PSYLLA.

Adult female, natural size, indicated by side line (original).

Kerosene emulsion diluted seven times, any time during the winter; spring application, which should be made immediately after the leaves are well unfolded and the eggs deposited by the hibernating individuals are hatched, with kerosene emulsion diluted nine times; modified bordeaux mixture may be used instead of water to dilute, which makes a happy combination for leaf-blight as well. For the information of those not familiar with this insect, would say that this insect is an old offender in the eastern states, but has not spread much here as yet. It is very minute and easily overlooked, though deadly to leaves and fruit, which drop prematurely. Its pres-



PEAR-TREE PSYLLA.

Nymph—greatly enlarged (original).

ence is first noticed by the slow growth and withered appearance of the new shoots, but later more pronounced by large quantities of sweet, water-like, sticky liquid, called "honey dew," which often covers all parts of the tree. A black fungus soon grows all through this honey dew and thus gives the tree a disgusting blackish appearance.—*Bulletin No. 108, Cornell university experiment station.*

FOR NURSERY STOCK.

Use either No. 1 or No. 2 spray as soon as the leaves have dropped; again in spring, as first leaves appear, with modified bordeaux mixture; fumigate all trees and shrubs with hydrocyanic acid gas before shipping.

FOR SQUIRRELS, MICE AND RABBITS.

Extracts from bulletin No. 111, New Jersey agricultural college experiment station: *Raubenleim* and *Dendrolene*. Both are crude petroleum products, the former by no means a new product. It has been long known in Germany, where it is used with good results to protect the trees from injury by the caterpillars, nunmoth, etc., and to prevent barking of trees by deer and rabbits. Either can be readily applied to trees with a paddle or trowel, and distributed by means of a stiff brush in such a way as to form an absolutely complete and continuous coat of any desired thickness over the bark. For borers it should be applied early in the season from roots up the tree 2 or 3 feet, at least three sixteenths of an inch thick. This will prevent oviposition by the adult of the peach-tree borer and kill all eggs or larvæ covered by it, as the material is not easily affected by the sun nor washed by rain, but remains soft; no insect can alight upon it and escape death. Where mice, rabbitts, squirrels or other animals are liable to attack fruit or other trees, a coat will serve as a protection during the entire season if put on one quarter of an inch thick. Extensive experiments in orchards and nurseries have proven that the materials are innoxious to trees where it is placed upon the bark of the trunk and even branches, provided that the growing tissue or buds be not covered. This makes it absolutely safe to use for the purposes for which it can be most effectually employed.

Messrs. Wm. Menzel and Son, 64 Broad street, New York, are the importers of "Raubenleim," and Prof. T. L. Nason,

New Brunswick, New Jersey, the manufacturer of "Dendrolene." No doubt our local dealers will soon carry them in stock to supply our home market.

OBSERVATIONS ON THE CLOVER MITE.

The past year has developed in alarming quantities a small shining vermillion-colored egg, placed on trunks and branches of fruit trees, frequently in such numbers as to entirely cover the bark. The tree frequently presents the appearance of having been daubed with red paint. They are more frequently found on the Petite prune than elsewhere, and are just visible to the eye under close inspection. Observers among growers have noted these eggs for several years past, E. Shipley, of James Valley, Oregon, having called attention to them as early as 1889. However, they have commonly been accepted as the eggs of the red spider and little attention paid to them. The alarming quantities in which they appeared the last season, and general distribution, has caused growers to inquire what they were and what damage may be expected from them. Careful inquiry has elicited the general agreement among entomologists that they are the eggs of the clover mite, which is distinct from, but closely allied to, the red spider. A complete treatise on this mite is to be found in "Insect Life," volume III, No. 2, issued by the United States department of agriculture, and can be had on application. The pest is said to often migrate to houses, and also causes the leaves of trees to turn yellow and drop prematurely. As yet no great damage has be done by them in Oregon, but it is feared such may be the case in the future. Close observations have been established by the state board of horticulture for the coming season, and, we are informed, Professor Cordley, of the state agricultural college, will make them a special study, so that in another season we may confidently expect to know of this mite as it occurs in Oregon. We feel confident that the salt, lime and sulphur spray will kill the eggs if applied in winter, but kerosene emulsion is generally recommended by those most familiar with this pest.

FOR CRATER-BLIGHT OF PEARS.

Prof. C. W. Woodworth, of Berkeley, California, says: "The nature of the disease is somewhat obscure, but the evidence seems to be that it is caused by an organism and is very similar

to the dreaded eastern pear blight. It is not, however, the same disease. Crater-blight first appears as a darkened spot, indistinguishable from any other form of blight. Like other blights, it commonly begins at the point on a branch where a twig is given off, or where one has been. There is this difference however: The crater-blight extends out only below the point of origin, whereas in other blights the disease extends upwards as well. The most characteristic feature of this blight is the sharp line of demarcation between the dead and live bark. When a spot has ceased to spread, there occurs a breaking in the bark, separating the diseased portion. This soon dries and the spot appears like a crater. This appearance is most striking when isolated spots are seen on the larger branches."

Treatment.—Cut out the dead and diseased tissue, clean and wash with bordeaux mixture; cut off all dead and blackened limbs.

Under date of July 27, 1896, Professor Woodworth adds: "We have made some progress in the study of the disease, in that we are very uniformly able to obtain pure cultures of a peculiar bacillus. Inoculation experiments have so far given only negative results. The disease occurs on many varieties of pears and only a few apples. The crater-blight certainly occurs in Oregon. I have had very typical examples from there and obtained the usual bacterial cultures from it. Economically the crater-blight in most localities is unimportant, but in some places it has done an immense amount of injury."

PEACH-ROOT BORER.

The worst insect pest of the prune and peach trees in the Willamette valley, and probably over the entire state, is the peach-root borer. It does not, however, seem to be equally distributed and in the same sections of country, and orchards in close proximity to each other show a wide difference as to the numbers of this pest. Weakly trees, or those with dead-spots on trunk or roots, are quite sure to be infested. The Silver and Petite prunes are also much more subject to their attack than the Italian. Occasionally they are found in the roots of the cherry, on Mazzard stock, but not often. It is quite probable that but few prune orchards are entirely exempt from this pest, as it works on Myrobolan stock as well as peach roots, but many are not yet seriously affected. The developments this season in certain advanced orchards show very

conclusively that this pest must be subdued, or they will surely kill the trees. From what we can learn there seems to be some question from an entomological standpoint about the borer, which infests our orchards, being identical with the eastern species. Professor Cordley, of the agricultural college at Corvallis, is now looking into the matter, and will, no doubt, later on give us full and accurate information on this point. For practical purposes, we are sufficiently informed to make the following statements: The moth lays its eggs at the base of the tree in the months of May, June, July and August. The eggs hatch in about a week, and the worm at once begins to gnaw the bark, and bore its way down into the roots. It lives in the root for one year, and comes forth a winged insect the succeeding spring and summer, and lays the eggs for the next brood, as stated. The presence of the worm is always betrayed by the copious exudation of gum, which issues from the roots at the base of the trunk.

Remedies.—There are a large number of remedies for this pest which are more or less successful, but where trees are cultivated on a large scale many of the remedies become entirely too expensive. A very popular and successful plan in the peach region of the east is "mounding." Early in the spring, before the moth appears, the earth is drawn about the base of the tree to the height of 12 inches, and removed later in the season, about September 1, in this climate. The use of washes intended to poison the worm have been much used, the following formula being the most successful:—

Ingredients—Corrosive sublimate (poison), 2 ounces.
Hard soap, 5 pounds to 10 gallons of water.
Alcohol, 1 pint.
Water, sufficient.

Directions.—Dissolve the sublimate in the spirits; stir it into the soap solution; add water sufficient to make a good paint; apply with stiff brush from three inches below to six inches above ground. This must be done as soon as the first moth appears in the spring. The worm will be poisoned by the corrosive sublimate almost at the first mouthful. Great care should be observed in using this wash, as it is very poisonous and dangerous to have about the house.

Of all the remedies we have known none have proven so sure and practical as cutting the grubs out with a knife and preventing their return by wrapping. In the fall of the year remove the earth carefully from the base of the tree; locate

the worms and cut them out with a knife. Repeat this in the spring about April, and at the same time wrap the trunk of the tree with stiff paper or other close material, allowing it to extend 6 inches above and 3 inches below the ground. This will prevent the moth from laying her eggs in the bark, and is the surest way we know of to defeat the ravages of this insect. Raubenleim and Dendrolene are used in Europe.

PRESERVING FRUIT FOR EXHIBITION.

Boil the quantity of water to be used and allow the sediment to settle, then pour into a barrel or clean wooden receptacle until about two thirds full. On top of the water float a quantity of sulphur in a tin basin. Set the sulphur on fire and cover tightly until the fire goes out; renew the sulphur until the whole is consumed, removing the cover for renewal of air between doses. Stir the liquid at each firing. Use about 1 pound of sulphur to each 20 gallons of water. To every gallon of water add 8 ounces of glycerine and ½ ounce of corrosive sublimate to keep the fruit from bursting. Seal the jar hermetically.

The above is the best recipe for keeping fruit in its natural size. There is but one objection to it—it is apt to bleach some varieties; so, in selecting fruit to use this on, be careful to get that which is naturally light colored. For dark-colored fruit I send you the following: Salicylic acid, 1 ounce to 5 gallons of water. Dissolve the acid by boiling. For preserving for a long time, use 1½ ounces to 5 gallons; dissolve the last ½ ounce by the cautious addition to the boiling water of enough sal soda to make the water clear, and to make it remain so after cooling. It is of great importance that not a particle more of sal soda be used than is sufficient to dissolve the last flake of acid, as the least excess of soda will tend to soften and discolor the fruit. Be very careful in hand-picking the fruit, so as to get it free from bruise or dint. Be careful, also, to cut the stems, and not break them off or tear them out. Attend to it promptly as soon as removed from the tree.

ANOTHER FORMULA.

Ingredients—Salicyclic acid, 5 drams.
Alcohol, 4 ounces.
Purified glycerine, 5 ounces.
Distilled water, 5 quarts.

Dissolve 2 drams of salicylic acid in the 4 ounces of alcohol in a pint of water at boiling temperature. Filter, and after

dissolving glycerine in hot water, add altogether, and place fruit therein and seal tight. If fruit is overripe, use 5 ounces of glycerine as above; if not, use 6 ounces of glycerine.

FOR RED FRUITS.

For preserving red fruits place one part of boracic acid in one hundred parts of distilled water (5½ drams boracic acid to ½ gallon of water), and put fruit therein in hermetically sealed jars.

FOR YELLOW FRUITS.

For preserving yellow fruits use sulphureted water. Druggists will prepare it.

KEEPING FRUIT FRESH—A NEW FRENCH METHOD BASED ON ALCOHOLIC VAPOR.

The great difficulty experienced in preserving fruits in their natural state is such that dealers who attempt to furnish them out of season are compelled, on account of the heavy losses they sustain, to sell their goods at very high prices, thus making them a luxury, and rendering it impossible for the great majority of families to place fresh fruit on their tables during the winter months. The solution of this question is, therefore, of great interest, and the experiments of Mr. A. Petit, chief of the national horticultural school of Versailles, in this direction tend to solve the problem. Impressed with the powerful action of alcoholic vapors on the mold which generally appears on the surface of fruits in a damp atmosphere, Mr. Petit noticed that pears and apples kept for several months in a surrounding saturated with vapors of water and alcohol, even were they at the beginning in a state of decay, showed no signs of mold, while fruits stored under similar conditions, but not exposed to the action of alcoholic vapors, were entirely covered with it. Taking advantage of this observation, Mr. Petit applied the principle to the preservation of fruits in general, especially to grapes, which mold very readily. He placed a variety of fresh fruits and a bottle filled with 61 cubic inches of alcohol at 96 degrees in a brick recipient in the form of a parallelopiped, cemented inside, and closed as hermetically as possible by a common wooden door. In two similar recipients contiguous to the first, one of which was kept

open and the other closed, but without alcohol, were stored similar fruits from the same trees and vines. The fruits were laid on wooden shavings. The recipients were built in a very damp cellar, the temperature of which varied from 46 to 50 degrees, Fahrenheit, during the time the experiment lasted, nearly two months, from November to January. After 20 days the grapes in the open and closed recipients without alcohol were mostly rotten and covered with mold, and were immediately removed. In the alcohol recipient the grapes were beautiful, being firm, free from mold, and not sour to the taste. At the end of two months each bunch of grapes had lost but from two to four berries, and all were in a perfect state of preservation, having all the qualities of fresh-cut grapes. Seventeen cubic inches of alcohol remained in the bottle. The process is certainly simple, easy of application, and cheap, and, if adopted by our fruit-growers, would allow them not only to hold their fine fruits until they can dispose of them, but would insure them handsome profits during the winter months.—*From the Scientific American.*

GOPHER REMEDY.

The discovery of any remedy which is sure death to gophers or squirrels is of the very greatest utility to people, as many of our young orchards are greatly damaged by these rodents. We append the following remedy, which is the result of years of experimenting: Take a five-gallon can, cut the top off, put in a little cold water, and insert a stick of phosphorus; hot (not boiling) water is then gradually poured, and stirred with a stick until the can is nearly full. The water should be just hot enough to melt the phosphorus gradually. As soon as the phosphorus is melted the water is briskly stirred, while two pounds of sugar are added. Corn meal and flour, half and half, is then added sufficient to make a thick batter. Stirring is continued while wheat is put in until the batter is quite stiff. Fifteen to twenty drops of oil of rhodium is put in at the same time as the wheat. The water will be absorbed by the grain, and the mass will become hard. Pieces the size of a hickory nut are chipped off as desired and put into the main runs of the gophers. The odor will attract the rodents from a long distance, and the least nibble is sure death. One piece is sufficient to destroy an entire family.

PLANTING TABLE.

So many mistakes have been made in planting trees too close together, that again we give a general table, taking in consideration the strength of soil, variety and nature of the tree, as well as climatic conditions:—

DISTANCES.

	Feet.
Pears	24 to 30
Apples	30 to 40
Apricots	20 to 22
Cherries	25 to 30
Peaches	20 to 25
Prunes and plums	20
Nut-bearing trees	30 to 40

NUMBER OF TREES TO THE ACRE.

	Square.	Triangular.	Quincunx.
Ten feet	436	500	331
Twelve feet	303	347	571
Fourteen feet	222	255	415
Sixteen feet	170	195	317
Eighteen feet	134	154	249
Twenty feet	108	126	193
Twenty-two feet	90	103	177
Twenty four feet	76	86	133
Thirty feet	48	56	83
Forty feet	27		

APPENDIX

PLANTING OF THE APPLE TREE.

Come, let us plant the apple tree,
Cleave the tough greensward with the spade.
Wide let its hollow bed be made;
Then gently lay the roots, and there
Sift the dark mold with kindly care,
And press it o'er them tenderly,
As round the sleeping infant's feet,
We softly fold the cradle-sheet;
So plant we the apple tree.

What plant we in this apple tree?
Buds, which the breath of summer days
Shall lengthen into leafy sprays;
Boughs where the thrush with crimson breast
Shall haunt and sing and hide her nest;
We plant upon the sunny lea
A shadow for the noontide hour,
A shelter from the summer shower,
When we plant the apple tree.

What plant we in this apple tree?
Sweets for a hundred flowery springs
To load the May wind's restless wings,
When from the orchard row he pours
Its fragrance through our open doors;
A world of blossoms for the bee,
Flowers for the sick girl's silent room,
For the glad infant sprigs of bloom,
We plant with the apple tree.

What plant we in this apple tree?
Fruits that shall swell in sunny June,
And redden in the August noon,
And drop when gentle airs come by,
That fan the blue September sky,
While children come with cries of glee,
And seek them where the fragrant grass
Betrays their bed to those who pass,
At the foot of the apple tree.

—WILLIAM CULLEN BRYANT.

ANNUAL ADDRESS.

Address of PRESIDENT E. L. SMITH, at the annual meeting of the state horticultural society in January, 1896.

GENTLEMEN: In horticultural parlance, our organization, with one shining exception, has been in the cocoon state during the past year. With an empty treasury, no revenue, an undefined jurisdiction and a limited membership, it was not within the power of your officers to infuse sufficient life into the society to render it of value to the fruit-growers of the state. But three committees have been appointed. This is from the unwillingness of those appealed to. Some urged exemption on account of past services, and others frankly stated that, in their opinion, the state board and agricultural college covered the ground and that there was really no field left for the state horticultural society.

The floral section is the shining exception to which I have alluded. At my urgent solicitation, Mrs. J. C. Card consented to reappointment as chairman of the committee on flowers and nobly has she discharged its duties. The thanks of this society are due to her and her efficient assistants for energy, zeal and good judgment displayed in the conduct of the floral section.

Your chairman also appointed a committee on new fruits, consisting of James R. Shepard, of Polk, E. R. Lake, of Benton, and J. H. Lambert, of Multnomah, and an executive committee, consisting of Henry E. Dosch, Buell Lamberson and Frank Lee, all of Multnomah county, and my thanks are due to these gentlemen for valuable services rendered.

It was the intention to have held a meeting during the fall season, but no community expressed a desire for the presence of the society, the numerous state, district and local fairs apparently absorbing the time and interest of the fruit-growers. Our secretary and treasurer, Hon. C. B. Watson, of Ashland, whose absence I regret, generously offered to canvass the Willamette valley and endeavor to arouse greater interest in our society and the cause it stands for, providing transportation and necessary expenses could be provided for. Presuming that there was a community of interest between the railroads and fruit production, I solicited free transportation for our secretary during this proposed canvass, but was informed that the regulations of the company to which I applied would not permit of its being

granted. In justice, however, to the company, I will state that a half-fare rate was tendered. I am also advised by Mr. Watson, under recent date, that he has been disappointed in securing attendance or papers for the meeting from the prominent fruit-growers of his part of the state, and that personally he did not feel like expending $30 or $40 to attend a meeting when so little interest was manifested. Your chairman also addressed numerous letters to leading horticulturists, requesting attendance and papers; but, as a rule, has received only excuses and regrets. The past year's experience has amply demonstrated to me the fact that the greatest impediment to progressive, successful fruit-culture is the apathy and indifference of those engaged in the pursuit. Indeed, I feel that during the year we have taken a step backward, not only in the work of our society, but in the removal of the office of the state board from the metropolis to a place where it is not readily accessible to the eastern portion of the state or to those coming from other states with a view of engaging in the fruit industry.

It was thought a year ago that considerable revenue would be derived from the sale of the Lambert cherry, a seedling of great merit and value, generously donated to the state horticultural society by the originator, Mr. J. H. Lambert. The committee on new fruits, headed by Mr. Shepard, has taken great interest in the matter and its report will explain why we cannot expect any considerable revenue from this source.

Your chairman does not share in the opinion that there is no field of labor for a state horticultural society in Oregon. Many of us who are devoting time and means to orcharding would welcome and find invaluable the methods and experience of other growers. The state horticultural society, in this as well as other states, should be the vehicle of important educational work. Mistakes would be avoided, errors corrected and failures averted, if we could popularize the experimental work of the general government and the more valuable field work carried on in our state. Artificial fertilizers are rapidly coming into use and their sale should be subject to state regulation, so that we may know what we buy. Our laws and the enforcement of them relative to the interests of the fruit industry are new and hence imperfect, and the state horticultural society should be the place for critical discussion of these and kindred subjects of legislation of the greatest importance.

It is doubtful if any portion of our country can show a greater percentage of as arable soil, adapted to gardening, and I use the word in its comparative sense, than Oregon; and it will, indeed, be lamentable if we neglect any means to promote this most promising industry.

ANNUAL ADDRESS.

By HON. E. L. SMITH, president of the state horticultural society, January, 1897.

Agriculture and horticulture, the two oldest arts practiced by man, have been the last to claim from the educator of the day the attention they demand.—*American Gardening*, December, 1896.

There are two prerequisites to successful fruit-growing—faculty and qualifications. When a lad we read "*Poeta nascitur, non fit*" ("A poet is born, not made.") On the profession of horticulture we would vary the phrase to run "A fruit-grower is born, not made."

It is just as essential to have adaptation in horticulture as in any other calling or profession, and it is equally as essential that genus should be supplemented by special education.

Who has not noticed two farmers or orchardists, with equal opportunities, one a success, the other a failure, and when we seek the cause of failure, do we not usually find it rooted in a want of what I call faculty, or in intelligence?

Fruit-growing is beset with so many adverse conditions requiring both aptness and special training to overcome them, and this brings to the foreground the subject of horticultural education. One of our best known and most energetic horticulturists said to me a few weeks ago, "I wonder what will be done up at Salem this winter with our state board of horticulture? It really seems to me that so much has been published that the people need no further education and that anyone ought by this time to know how to plant and raise an orchard."

From such a conclusion I must dissent. It is quite true that the state board, the state horticultural society, the agricultural college and experiment station, and that invaluable auxiliary, the press, have given us a vast amount of information. They have taken us by successive steps from the transplanting of the tree in the nursery to the packing and marketing of the harvest. They have told us how we should cultivate and prune and spray; they have crammed us with entomology and myology, and yet I am here to maintain that we, the fruit-growers of Oregon, have as yet but reached the threshold of knowledge in our chosen pursuit, and that to cease horticultural education would be as

fatal to fruit-growing as the abolition of our public schools would be to the cause of elementary education.

Fruit growing today has become to a great degree a scientific profession. We must understand not only the chemistry of soils, but of washes and of sprays, and we hopefully await the discovery of some non-poisonous mixture that will take the place of london purple and paris green. We must learn the natural history of those predatory hordes that consume and exhaust the life-giving tides of growing trees; we must learn to battle with myriads of unseen spores that fasten upon leaf and fruit only to deform and destroy. Each season brings some new disease, and we must delve in vegetable pathology, and study and experiment to find some vulnerable point of attack; some effective remedy. For example, the leaves of our Italian prunes roll into cylinders. Who shall first point the cause and prescribe the cure? We must have organized agencies to collate and popularize that which is most valuable in the various experiment stations and the no less valuable experience of the progressive orchardists of our state. We must have associations to voice our wishes relative to remedial legislation, and to see that wholesome laws are given force and effect. We cannot depend upon individual interest and effort to do this work. It will never be done without combination and organization.

I am gratified to note that our agricultural college has provided for a short course in horticulture, and it would be a matter of still greater satisfaction if the lectures of the course would be published and placed in the hands of the fruit-growers of the state. And this leads me to say that the usefulness of the society would be greatly enlarged if the more valuable papers read before it could be published by the state. Year after year we come together at our own expense, in the interests of a great and growing industry. We have never asked an appropriation from the public treasury; but we believe the discussions of the society are of sufficient importance to warrant their publication and distribution. A manual for the Oregon fruit-grower could be compiled, from the exceedingly valuable papers embodying scientific research and many years of intelligent observation in the field, that have been read before the society. I believe that this beneficial work should be continued. The possibilities of Oregon for fruit-growing must not be neglected, but receive our fostering care. And we who are engaged in this industry, and the thousands who will hereafter plant our valleys and hillsides, must have light, more light in horticulture.

SETH LUELLING.

> "When the hour of death comes—that comes to high and low alike—then it's na what we hae dune for ourselves, but what we hae dune for others, that we think on maist pleasantly."
> —SIR WALTER SCOTT.

There was born in South Carolina on the sixth day of March, 1819, a boy who was destined to be a factor in the promotion and advancement of the interest we represent, in a state then known only to the fur-traders of the far West, and built a monument to his name which will last until horticulture ceases to be an industry. His parents removed with him to Newcastle, Indiana, where his father established one of the finest nurseries in the west of that day; but his star pointed still further west, and emigrating in 1847 to Oregon, and settling in Milwaukie, where he resided, fulfilling the mission for which he was sent into this world, until February 21 of this year, when his work was ended, and he passed to the great beyond, to meet those friends gone before him and who awaited his coming to the other shore. The name of

SETH LUELLING

will be inseparable from the Black Republican and Bing cherries and Golden prune, which are the results of his careful and painstaking work. Though of Quaker parentage, he professed no creed or faith; his studies had convinced him of the truths of spiritualism, and he had no doubt of his continued life. Feeling that his life and work was a grand success, we, your committee, beg leave to offer the following resolutions:—

Whereas, the strong arm of that mighty conqueror of all that is earthly has again manifested his power in removing from us our highly esteemed friend and associate, Seth Luelling; and

Whereas, the termination of a life so valuable to his family, his neighbors, his friends and the state at large, brings us to realize in a forceable manner the uncertainties of life; and

Whereas, in the death of nurseyman and fruit-grower, Seth Luelling, we horticulturists, especially, have lost a most ardent helper, the state a valued citizen, the family a loving husband and father; therefore, be it

Resolved, That the state horticultural society desire to express the feelings of regret that each member feels at this termination of so valuable and useful a life, and that we the members of this society unite in our expression of sympathy to the wife and children of our esteemed associate in this their great sorrow.

HENRY E. DOSCH,
J. R. CARDWELL,
C. E. HOSKINS,
Committee.

HORTICULTURAL EDUCATION.

By H. M. WILLIAMSON.

The Oregon state board of horticulture has asked the state board of education to provide for giving instruction in the rudimentary principles of horticulture in the public schools of the state. Are there good grounds for this request? If horticulture is to be taught in our public schools we must have teachers who are competent to give instruction therein, and our normal schools, like those of France and some other countries, will be compelled to have orchard and garden attachments wherein the budding teachers may qualify themselves to give instruction in horticulture. In fact, every school which divides with the normal schools the work of preparing youth for the profession of teaching in the common schools will be obliged to employ teachers who are well grounded in the art and science of horticulture, and the state agricultural college must prepare itself to supply the demand for this higher grade of horticultural teachers. The request of the state board of horticulture, which, at first thought, seems so plainly right, begins to look formidable when we see what it involves. There are many people in Oregon who firmly believe that we are already doing far too much in the way of public education. They would, if they could, close the doors of our state university, agricultural college, normal schools and the city high schools. "When the public schools have taught the children to read, write and cipher they have done enough; let those who want more education pay for it," is their motto. Their theory of public education may be very self-satisfying, but the hard facts of experience, or in other words, the historical method of investigation, show that those nations, states and communities which do the most work in the way of public education are the most prosperous as well as the most progressive. The doctrine which would confine the educational work of the state to the three R's is the child of aristocracy and selfishness, and if it should become the controlling idea in Oregon, intelligent and progressive people would move out and the state would become in the character of its people, like mute China. But this will not happen. The spirit which

animates the people of Oregon is similar to that which has stirred up Japan rather than that which keeps China jogging along in the good old way which it has followed without deviation for cycles of centuries. If the people of Oregon can be convinced that horticultural education pays, that the practical results will justify the cost, we may expect the prayer of the state board of horticulture will be granted in full measure.

To many of us the benefits of horticulture, as well as other agricultural education, seem so plain, that we are apt to forget that these benefits may not loom up so clearly before the vision of others. When, a few years ago, representatives of the Oregon dairymen's association were trying to get a measure through the legislature which was intended to promote dairy education in the state, a very prominent member of the legislature, who has since been a candidate for congress, plainly and bluntly stated that dairy education is a humbug. Now, this gentleman has the reputation of being well versed in law, and was supported for congress in the late campaign by the leading paper of the state on account of his views on the intricate money question, but he did not know that the little kingdom of Denmark—only one sixth as large as Oregon—has, as a result of dairy education, increased its exports of butter during the past thirty years from thirteen million pounds per year to one hundred and forty million pounds per year, and at the same time advanced the average price received while elsewhere prices were tending downwards. He did not know that Canada, by hiring the best cheesemakers and dairy experts it could find in the United States, and elsewhere, to give its people dairy instruction, has increased the value of its exports of cheese from $4,000,000 in the year 1880, to $16,000,000 in the year 1895, and has developed such proficiency that at the Columbian exposition in Chicago, Canada took four hundred and seventy-nine awards on cheese while the United States only secured forty-five, and the judges scored one hundred and thirty exhibits of Canadian cheese higher than the best exhibit of United States cheese. He did not even know what dairy education has done to promote the prosperity of Wisconsin, Iowa and Minnesota, or he would not have said that dairy education is a humbug.

Unfortunately, there are a great many people in the state, who, on account of their utter ignorance as to what has been done in this line, believe that agricultural education in all its branches is a humbug.

Oregon is adapted by nature to become a great fruit-growing state. Our climatic conditions are the best which can be found in the United States for the production of deciduous fruits. We have tried in a rather blind way to take advantage of this fact

by extensive planting of fruit trees, and at the present time the investments in orchards in Oregon amounts to not less than ten millions of dollars. No person, however, who has looked on the orchards of the state can fail to come to the conclusion that one half of the money thus invested will prove a loss. Five million dollars is a large sum. The loss of this amount cannot fail to injuriously affect the general prosperity of the people of the state. Is it not a fact that the greater part of this loss has been due to the lack of knowledge of the elementary principles of horticulture and dense ignorance of the business of fruit-growing?

We cannot afford to go on losing millions in the fruit-growing industry. It may also be reasonably expected that a proper system of horticultural education will do as much to build up the fruit-growing industry in a state like Oregon as dairy education has done to build up the dairy industry in Denmark and Canada. If we are to gain in fruit-growing as they have gained in dairying, we must take the leading part in horticultural education which they have taken in dairy education. Those states whose growers take the lead in the application of properly-trained brains and accurate knowledge to their business will get a hold on the general markets of the country which will make competition on the part of other states a difficult matter. There can be no doubt that we are about to enter upon an era of general horticultural education in the United States. No branch of agricultural industry has attracted so much attention throughout the country during the past few years. We have begun to investigate the business and to find out how great the opportunities are for improvement. Our breath is almost taken away by the discovery that the average annual yield of a bearing apple tree in the United States is only about one bushel, and that Oregon is in this respect no better than the rest of the country. From the facts brought out by the last census it appears that the average bearing fruit tree only yields from one fourth to one tenth as much as a skilled and successful orchardist would call an average crop. The discovery that such is the fact is a powerful incentive to horticultural education and will bring out a general demand which will be heeded.

To make fruit-growing a profitable business in Oregon it is requisite that we be able to place upon the market better and more attractive fruit than our competitors; that we produce such fruit at as low a cost, and that we use as much or more business ability in marketing it. If our acreage of orchards in Oregon today were cut down by one half, and the remaining half were in the hands of men who had entered upon the business with a special training therefor, we would be producing more fruit and

better fruit than we are now doing, and the prospects would be much brighter for a rapid development of a great fruit-growing industry in the state.

It is true that our public schools can at best do but little in the way of horticultural education. The education given therein should, however, open up the subject to the pupils; give them some correct knowledge of both principles and practice, and send them forth with a clear understanding of the fact that a person should no more expect to achieve success as a fruit-grower or gardener without making a special study of the business than to become a successful physician without special preparation. The common schools can give their pupils a start in the right direction, and the value of the right kind of a start can hardly be overestimated. If the fruit-growers of Oregon at the present time had enjoyed the benefit of such horticultural instruction as it is possible to give in the public schools, there would be live horticultural societies in every fruit-growing neighborhood in the state; the agricultural college would be overwhelmed with calls for the services of its professors; farmers' institutes, with strong horticultural features, would be held by scores every year; fruit-growers would keep themselves abreast of the horticultural progress of the world; their views would be broadened and their minds strengthened and better fitted to grapple with the difficult problems involved in the successful marketing of their products. In short, the logical result of such horticultural education would be to make our fruit-growers progressive.

HORTICULTURE AND ITS REQUISITES.

By Henry E. Dosch.

"The law of nature is that a certain quantity of work is necessary to produce a certain quantity of good of any kind whatever. If you want knowledge, you must toil for it; if food, you must toil for it, and if pleasure, you must toil for it."—Ruskin.

The first thought that enters one's mind is, what is horticulture? If we look into Webster's dictionary we find, "the art of cultivating gardens and orchards," and a horticulturist is "one who is skilled in the art of cultivating gardens and orchards." If we look into the Encyclopædia Brittanica we find "horticulture embraces the art and the science of the cultivation of flowers, fruit and vegetables." Please note the emphasis placed on the words "art and science," the subject being treated from a scientific and practical standpoint, covering eighty-five pages of closely printed matter. But does it not mean more? When the Creator of this universe laid out the Garden of Eden and planted trees for ornament, as well as fruit, he placed therein the first couple and intended them to be horticulturists; they were happy as long as they remained in their country home. But in an evil hour they were driven out, and ever since man has striven to place those who were given him to love and care for in a similar Garden of Eden.

Many of you may be dissatisfied with your farms and orchards but you do not seem to know how very much better you are situated than your city friends. It is not all gold that glitters and I am in a position to know whereof I speak. During my ten years' service as horticultural commissioner in Oregon, I have received hundreds of letters from all classes of city people—lawyers, doctors, merchants, bookkeepers and other clerks, yes, even from lady typewriters, asking my advice about horticulture as a better employment for them. And why have these people sought my advice? Not because I have made a success of horticulture, but because the politician has found that office-seeking and political power is a snare and a delusion; others have found that the chase after gold, even to the Klondike, is delusive and seldom reached; and many others have found that social position is but a bubble

after all; and finally, after their various disappointments, sick at heart and ill in body, they turn to nature for their solace; it brings them nearer to their Creator, and the nearer they get to Him the less disappointments they meet and the more peace, happiness and contentment they find. He speaks to us through the flowers and vegetables we grow in our gardens, through the fruit trees we plant and cultivate, and through the lovely songs of the birds that fill the air. Ah, my friends, there are very few men, even if they do achieve all their heart's desire, be it money, political power or social position, who will not sooner or later turn to nature.

Reynolds, the great horticulturist, writes: "The farm is a good place on which to be born, on which to live through one's prime work, on which to die." Sometimes it happens that one who has spent his boyhood days on a farm, may, when he comes to struggle for himself, stray away to town and engage in one of the numerous avocations which men there pursue for a livelihood. However successful he may prove in business in town, there comes a time, as old age approaches, when his thoughts turn back to his earlier life in the country, its independence, its calm, healthful enjoyments amid scenes and products of nature, and he feels a strong, overmastering desire to spend his later years and die in the country, on the bosom of the great mother of us all, generous, teeming earth."

Occasionally I am asked by a friend this question: "I cannot understand how you can live in the country when you can live in the city," and my reply is: "I cannot understand how you can live in the city, when you can afford to live in the country, for it is a privilege, and some day you will find out."

When Jefferson warned us that America would degenerate as soon as it ceased to be an argicultural and horticultural nation, he touched the keynote, for he foresaw the coming greed for money; that fearful fight for political power which seems to have reached its height just now; that getting something for nothing, and that struggle for social position and prominence.

William Cullen Bryant says:—

"What plant we in the apple tree?
Sweets for a hundred flowery springs
To load the May wind's restless wings,
When from the orchard row he pours
Its fragrance through the open doors;
A world of blossoms for the bee,
Flowers for the sick girl's silent room,
For the glad infant sprigs of bloom,
We plant with the apple tree."

It is said that John Ruskin "somewhere marveled at the wonderful conception of God's mind when he first thought of a tree."

There could have been no paradise for man without trees. He caused to grow those trees that were pleasant to the eye as well as good for fruit. Just fancy what this world would be without trees.

There is an inseparable companionship between trees and man not readily accounted for, and there are few men who lack the desire to plant and surround themselves with trees. I cannot conceive a perfect home devoid of trees. What is more beautiful to the eye than a well laid out and perfectly kept orchard?

ORCHARD SOILS.

Most of you are, no doubt, familiar with orchard planting, but as some may be contemplating planting and desire the necessary information, permit me to begin at the beginning. The first thing to be considered is the location and selection of soil.

Different kinds of fruits do better in certain kinds of soil. For instance, pears do best in iron clay soil; apples prefer a loam, and prunes, peaches and cherries, as well as the nut-bearing trees, a gravelly loam; but any soil can be made available, provided it is not underlaid with hardpan. Such soil is to be shunned, as it forms a watershed and is impenetrable to the roots, which will spread out on this hardpan and, as trees do not like to have their feet (roots) in the water, become diseased and finally die.

DYNAMITING SOILS.

To dynamite such soils, which is the only way to aerate it, is rather expensive, and as long as we have plenty of good soil available we shall leave this work to future generations, although such soils properly dynamited, would make an excellent orchard. As the aeration of our heavy clay soils is one of the problems, I may state the *modus operandi.* Bore holes at regular distances, twenty or even thirty feet apart, about eight feet deep with a three-inch augur; put in a stick of dynamite, with sufficient fuse to reach the surface, and then tamp the soil in again firmly, and set it off. This will not blow it up, but shatter the ground and subsoil in all directions from ten to fifteen feet, and the work is done. I am of the opinion that our cold, white soils of Polk and other counties would be largely improved, and feel confident that instead of producing only eighteen to twenty-five bushels of wheat would yield forty to fifty, if treated in this way. The proceeds from the sale of this increased yield the first year would probably cover the entire cost of dynamiting. Fruit trees planted on soil thus treated can send their roots down deep for a continuous supply of moisture and nourishment in summer and

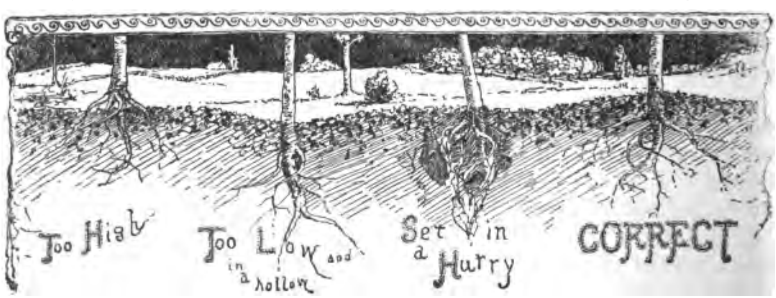
the land would be so thoroughly drained that the trees could better resist the attacks of such fungus diseases as are caused by the roots standing in too much water during our winters. Experiments made in Utah and California have proven very successful.

Nor is very rich soil desirable. This encourages too much wood growth, and trees will not set fruit buds. Besides, trees set in rich soil will be longer coming into bearing than similar trees in poorer soil.

Mr. Joseph Mechan says: "The general impression is that trees are better conditioned and longer lived when in soil of moderate fertility," and this impression is probably correct. The growth is then moderate and fruit bearing comes at the proper time, neither too early nor too late. Wet and undrained land is also to be avoided, as it produces dead-spot or canker on the trees—a deadly fungi. Perhaps the best time to select orchard soil is in the month of February or March—by digging holes five feet deep in various places. If after a few days water has gathered in these holes, cover them up, and don't plant any trees; but if they remain comparatively free of water, thus showing that the water can percolate through to the storehouses below, to be taken up by capillary attraction when needed, we have an ideal orchard soil.

ORCHARD PLANTING.

Having selected the location, and after preparing the top soil by plowing and subsoiling, plant the trees in the fall—yearling trees preferred—by digging generous holes at proper distances; put in the tree, spread out the roots carefully, and then gradually fill up, top soil first, then press the soil firmly with your feet, leaving the tree about the same as it stood in the nursery row.



This is a very important point, and it will pay you well to do this work with the utmost care, as the life of the trees and the future profit you may expect to derive from them depend mainly on how your trees are planted.

PRUNING AND CULTIVATION.

When all are planted, cut a stick the length at which you desire your trees to head out; for instance, 36 inches for apples and pears, 30 inches for prunes and cherries and 18 inches for peaches and apricots, and so on. Then go along and cut every tree by this stick, so all will have a uniform height. You will not regret this extra trouble when your orchard goes into bearing. The following spring plow as soon as the ground will permit, then harrow and cultivate, making a perfect dust bed if possible. Hoe each tree to kill all weeds and grass, and keep on cultivating until between July 1 to 15; then stop, allowing the wood to mature for winter. After New Year begin to prune by cutting away all the branches except three or four, and these cut back to three or four buds, pruning to two outer buds on all varieties of trees which have an ingrowing or upward growth, and prune to two upper buds on all trees known to have a spreading habit. Repeat plowing, cultivating and hoeing as before. The second year cut out all wild growth; cut back the new shoots on the branches left the previous year to five or six buds, leaving only two branches to each. Care must be taken not to cut away any embryo fruit spurs on any of the limbs; again follow with plowing and cultivating as before. Remember you are now making roots and body to carry the future heads and fruit. The third year's pruning does not need to be so severe; cut back about one-half of the new growth; all the lateral branches which may have formed on the old limbs cut back to two buds, thus encouraging fruit spurs to develop on them.

You now have a symmetrical head on a good body, with a fine root system. Growth will now be slower. This method of pruning and cultivating must be continued until the tree goes into bearing, when we must change tactics.

WHEN THE ORCHARD BEGINS TO BEAR.

Plowing in the spring must be deferred until after blooming and the fruit has set, then plow, disk-harrow and cultivate systematically until about ten to fifteen days before gathering the fruit, then stop. If plowed before the fruit has set, the stimulant given the sap flow will have a tendency to develop the leaf and limb buds at the expense of the fruit buds, many of the latter remaining dormant, or if developed will set weak fruit, most of which dies and drops off. Little pruning will be necessary except to cut out crossing or ingrowing limbs and heading back straggling, outgrowing limbs.

In Southern and Eastern Oregon late fall plowing to a depth

of not over four inches can be recommended to more readily absorb the rains and snows, permitting them to percolate through to the storerooms below for use the following summer; on unplowed lands it has a tendency to flow off. While it is desirable to have a fairly open head in Northwestern Oregon, it is necessary to protect the body to some extent against the direct rays of the sun in Eastern and Southern Oregon. Hence, while we in the northwest prune for sunlight, the other portions must in a measure prune for shade. By training prune trees goblet shape, and in pear and apple trees leaving the center limb surrounded by limbs, goblet shape, we will attain best results. Occasionally, trees continue to make too much wood, and will not bear fruit after having reached bearing age. It then becomes necessary to put the orchard into sod for some years. This will check wood growth and promote the formation of fruit buds.

FERTILIZING ORCHARDS.

Flowering and fruiting are very exhausting; hence trees should not be allowed to flower or bear too early, as it can only be done at the expense of health and possibly life of the tree. Especially is this the case with all drupaceous fruits. It takes more vitality and strength to form the pit than it does the rest of the fruit. When we find a bearing orchard declining in quality of fruit, it shows lack of fertility in the soil. I would advise the sowing of crimson clover (*trifolium incarnatum*), fifteen pounds to the acre, in August, or just after the last cultivation. The first rain will bring it up and it continues to grow all winter. In the spring, a week or two before plowing, sow on top of this clover, broadcast, about three hundred pounds of muriate of potash per acre; then plow all under and the result will be surprising. Speaking of the values of crimson clover, Prof. E. B. Voorhies, director of the New Jersey experiment station, says: "Crimson clover, or more commonly called scarlet clover, and Italian or German clover, is an annual, makes a growth of from 20 to 30 inches high, has a bright crimson blossom from one and a half to three inches long, and when in full bloom with its luxuriant growth of green foliage and its crimson bloom, is a thing of beauty, once seen never to be forgotten. It is a winter crop, must be sown in July, August or September of each year, from which the spring following can be cut for soiling by the latter part of April. It will produce on ordinary soil 12 to 15 tons of green food per acre or one and a half to two and a half tons of hay per acre. Used as a green manure only, the average crop per acre is worth $25. The average of manured crops on May 24 and 31, contained per acre 200 pounds of nitrogen and 6,500 pounds of organic matter, or equiv-

alent to that contained in 20 tons of city manure." It is further shown that crimson clover sown in orchards and before plowing under will retard the blooming of the trees, so desirable with us, on account of the late spring rains. Summing up, the professor says: "Crimson clover may be seeded in orchards, berry patches, corn, tomatoes, etc. Regarded as a green manure, particularly as furnishing nitrogen derived from the air, this crop possesses many advantages due to its time of growth and development."

Here we have just what is needed for our heavy clay soils. It renders the soil friable and porous, sending its root down to the depth of four feet, reduces the growth of weeds and enriches the soil. It is a rank grower and stools enormously. I have seeded my orchard twice with very good results.

WHAT TO PLANT.

The question naturally follows, what to plant? The soils and climate of Oregon are peculiarly adapted to prune culture, and the tendency would be to plant largely to prunes. While I am not a believer in over-production of good, marketable prunes, yet it behooves us to look somewhat into the future.

It is claimed that the Pacific coast now produces fully as many prunes as are consumed in the United States, and with the growing orchards coming into bearing we will overproduce, to overcome which we must reach out for new fields. Already our prunes have found a sympathetic market in England at fair prices; in Germany they have found friends at one mark (24 cents) per pound, and even created a demand in France, the very home of the Petite d'Agen, to such an extent that the growers have petitioned their government for a duty on imported prunes. A few days ago I was shown a letter from the Hon. William F. Grinnell, American consul at Manchester, England, dated December 7, 1897, stating that in a lot of apples received from Oregon and on sale in that city were found placards on which were printed: "Rogue river valley apples from the orchard of C. Kleinhammer, Phœnix, Oregon," saying that finer fruit had never been exhibited in that market and dealers wanted to secure the output for another year. Thus another and unlimited market is opened for the wide-awake fruit-grower, showing that intelligent endeavor, honest packing, brains and the application of business principles, which hereafter must be adopted in order to be successful in horticultural pursuits, has its own reward. And again, our new acquisitions in the orient, as well as Japan, offer a new and almost unlimited field for our evaporated fruits. It seems to me that overproduction of good, marketable fruit is a myth.

I have repeatedly stated for years past that as we become more civilized, educated, and learn how to live, the consumption of fruits—the proper food for man—will increase.

CONSUMPTION AND HEALTHFULNESS OF FRUITS.

Two factors are now assisting in this forward movement. *First*, the low prices which prevailed for several years past have placed evaporated prunes in many families as well as boarding houses in manufacturing and mining centers never reached before, as well as in the south, where, a new market just opened, the colored population being particularly fond of the French prune, the poor man's fruit par excellence, because they require very little sugar in preparation for table use, and once tasted they will never be without them again; and *second*, the doctors, aided by the medical press, are strongly advocating the consumption of fruits to promote health, not only in America but abroad.

Dr. Beutzer, of Germany, the noted scientist, and Dr. Sophie Lepper, the great English food specialist, give their emphatic endorsement of fruits as hygienic agents. Dr. Beutzer dwells particularly on the apple, and declares that an apple eaten immediately before bedtime will promote general health. Its dietical as well as alimentary substances are of the highest order. It contains more phosphoric acid in an easily digestible combination than any other vegetable product; while Dr. Sophie Lepper says: "Apples supply the highest nerve and muscle food, but do not give stay; prunes afford the highest nerve and brain food, supply heat and waste, but are not muscle feeding; walnuts give brain or nerve food, muscle, heat and waste." What a happy combination, apples, prunes and walnuts.

I have received letters of inquiry from the department of agriculture in England, Germany, South Africa and New Zealand as to the methods used in planting, growing and evaporating prunes, which shows that there must be an increased demand for prunes. In fact, so much is thought of prune-growing in South Africa that an article which I prepared for the horticultural commissioner of that far-away country was translated into Hollandish for the benefit of the Boers, who are deeply interested in horticulture. Overproduction in prunes is only possible in sizes running from eighty to one hundred and twenty and over to the pound; for sizes running from thirty to sixty, never. But the era for high prices has passed, nor do we want its return, for just as soon as prices advance consumption naturally decreases, which is not to be desired. I have proven on my own grounds that prunes at four cents per pound will net over one hundred dollars per acre. This is plenty good enough, and even could

stand considerable shrinkage in price and yet be more profitable than could be gained in any other agricultural pursuit.

VARIETIES TO PLANT.

It has been advocated to plant only one kind of fruit, so the grower could study it more closely and give his entire energy to this particular variety, be it apples, pears or prunes. This may be good advice to the planter of large commercial orchards, but for the average planter—from twenty to forty acres—I consider it ill-advised. I do not believe in carrying all my eggs in one basket, partly because all the labor comes at one time, and much money must be paid for help, and partly for occasional failures, either in productiveness or prices, in one or the other fruits. The time has come when one must do as much of his own labor as possible; it is both healthful and profitable, hence permit me to suggest the planting of the following varieties in given quantities:—

I shall take a 40-acre tract as may guide, which of course may be increased or decreased, always keeping in mind to grow sufficient of any horticultural variety to make a carload lot.

Fifteen acres of apples.—Varieties for Northwestern Oregon: Gravenstein, Wealthy, Duchess of Oldenburg, Northern Spy, Spitzenberg, Wolf River, King and Ben Davis or any four of them. For Eastern and Southern Oregon: Gravenstein, Wealthy, Baldwin, King, York Imperial, Yellow Newton Pippin, Wagener and Ben Davis or any four of them.

Six acres of pears.—Varieties: Bartlett, Fall Butter, Beurre Clairgeau and Beurre d'Anjou.

Ten acres of prunes.—Varieties: Petite d'Agen or French, Fellenberg or Italian, Clairac Mammoth d'Ente, a new French variety; Imperial Precose and Dosch prunes—the two latter are from ten to fourteen days earlier.

Three arces of cherries.—Varieties: Royal Anne, Oregon, Bing, Hoskins, Lambert, Kentish and Late Duke.

Three acres of French walnuts.—Varieties: Mayette, Parisienne, Franquette, Prœparturius and Columbus.

One half acre of chestnuts.—Varieties: Grosse Precose, Paragon, Nouzillard and Combale.

One half acre of almonds.—Grosse Tendre or Languedoc.

One acre of family orchard—Of such varieties as fancy suggests.

One acre of berries and grapes.

These varieties are all of commercial value and should be planted in equal numbers and alternate rows for pollination purposes of each horticultural variety, as apples do not pollinate pears or cherries and *vice versa.* In all my educational work I

have endeavored to explain this matter of pollination, and find that this subject is not alone little understood, but many are incredulous and absolutely refuse to believe in the existence of sexes in the vegetable kingdom.

POLLINATION.

Kindly permit me to quote from a paper by J. C. Whitten, of the Missouri agricultural college: "Before considering the subject of pollination it is necessary to get clearly in mind the relation and arrangement of the different parts of the flower. The ordinary complete flower is composed of a calyx, corolla, stamens and pistils in the order named. The apple flower is a good representative. The calyx is the green outer cup. It is the cover of the unopened bud and, expands, as the flower opens, into five parts or sepals. Just within the calyx is the corolla, consisting of five pink petals. This is the most conspicuous and ornamental part of the flower. Just within this corolla are the essential or productive organs. They consist of about 20 stamens and a five-parted pistil. The stamens are slender filaments, surmounted each with a little sack containing pollen. These are the male organs. The pistil is the central female organ of the flower. It consists of a five-celled ovary bearing the undeveloped seeds and five thread-like styles arising from it and terminating each in a fleshy surface, called the stigma. Some plants do not produce both stamens and pistils in the same flower. In the Indian corn the pistils are the silk at the ear, while the stamens are borne in the tassel at the top of the plant. Our pine trees bear two classes of little cones or flowers in the spring. One kind bears the stamens and is shed off after the pollen has been produced; the other kind bears the pistils, and after being acted upon by the pollen of the male cones, developes into the large cone from which we secure the seed. Other plants, like the box elder, soft maple, persimmon and cottonwood bear the different sexes upon separate individuals. This is also the case with many varieties of strawberries. The ornamental corolla is wanting in many flowers; so, also, may be the calyx. Each species, however, must always produce stamens and pistils, either in the same or different flowers. These being the productive organs of the plant are as essential to the production of fruit and seeds as are the two sexes essential to reproduction in the animal kingdom."

The existence of sex in plants has long been known and the manner in which pollen is carried has been the subject of years of patient study and observation. Some flowers are fertilized by the winds carrying pollen, while in others the ovary is set so

deep that it cannot be reached in that way, hence nature has made the flowers attractive to the bees and other insects by bright colors and deep-seated nectar, and in passing from one flower to another they carry the pollen on their wings and feet. Perhaps no man has given this matter more thought, especially cross-pollination, than Darwin, who says: "No organic being fertilizes itself for a perpetuity of generations, but a cross with another individual is occasionally, perhaps at very long intervals, indispensable." The most important conclusion resulting from Darwin's extensive studies along this line, during which he carefully compared his own observations with those of other investigators, is expressed in one of his own statements: "Nature thus tells us, in the most emphatic manner, that she abhors perpetual self-fertilization."

The normal typical fruits, and in most cases, the largest and finest specimens, either of self-fertile or self-sterile sorts, are crosses. Particularly is this true of the Bartlett and Beurre Claireau pears when crossed with the rich and vigorous pollen of the Fall Butter pear.

The finest strawberries we have, such as the Haviland, Bubach and others, are all pistilate blossoms, and must be cross-fertilized to bear fruit. When planted alongside of Wilson or Sharpless, which are known to be rich in male blossoms, they bear most excellent and luscious fruit.

I have also observed that my Italian prunes, when pollinated by the stronger French prune, give a larger, finer flavored fruit, and the dropping, which is very pronounced at times, has been very light. Italian prune trees, standing in my French prune orchard, bear heavy crops every year, while those planted in solid blocks have only partial crops, most of the fruit dropping off, which I now attribute to imperfect and weak pollination. Hence, the conclusion to plant all species of any given horticultural variety in alternate rows.

PROFITABLE.

Fruit-growing is not only a healthy and pleasant occupation, but a profitable one. It is stated on reliable authority (Bradstreet's agency) that throughout the United States there are fewer failures among those engaged in horticultural pursuits than any other branch of farming, and then the question is asked, "Is it owing to the business, or the men that engage in it?" I think it is both, especially the latter, for it requires brains to be a successful horticulturist. The old methods followed in Oregon so long will not do any longer. Horticulture is an art of the highest order. The planter must keep abreast of the times; he must study and

fight. He should be a subscriber to at least one horticultural paper, in order to keep posted on the latest improved appliances and experiences in all the phases of fruit-growing, usually written by progressive orchardists and competent editors, and by all means your own home paper, which should be supplied by you with short articles of interest to your neighbors about your success or failures in fruit-growing. No doubt these papers will be pleased to publish them, and by this means build up your own community.

SPRAYING.

I said fight, yes, fight insects and fungi. The old adage says:

> "He who fights and runs away,
> May live to fight another day."

But there is no running away in fighting in the orchard. We have to stay right with it and keep up the fight if we expect to succeed in raising good, marketable fruit. Nor is this such a great bugbear as one might think; it is the "getting at it" that is feared most.

There has been so much written and said about spraying that I almost fear to touch upon it, yet many of you want to know—and it is right that you should know, in fact, must know—if you propose to follow fruit-growing, for the enemies are here, and we must fight them in our own orchards to keep them out, and you will succeed if you go about it systematically and judiciously. Perhaps there is no subject which engrosses the minds of the most eminent professors of our experiment stations and of our successful fruit-growers more than the checking of fungus growth and insect extermination. Volumes have been written on this subject, but it is gratifying to state that we have reached a point which leaves us masters of the situation. And right here is where the intelligent, painstaking orchardist succeeds, when his less careful neighbor fails, sits down and says "fruit-growing does'nt pay." As "eternal vigilance is the price of liberty," so is eternal spraying the price of good fruit. The state board of horticulture has issued repeatedly bulletins on spraying, giving the various washes or sprays most useful in orchards, and it would appear superfluous to repeat them here, except to emphasize a few of the most beneficial against disease and insects.

Of fungus diseases the most dreaded is deadspot or apple canker, which usually attacks only apple and pear trees, but for several years past has also attacked prune trees. Then we have gummosis, of which there are different types, attacking all drupaceous or stone-fruited trees, as the peach, cherry, prune, plum

and apricot. These diseases must be fought with the knife by cutting out all canker spots and gum pockets, then wash or spray with full strength bordeaux mixture, which is the only remedy that has so far proven successful. Then we have pear blight and scab on apples and pears, which must be fought in early spring. *First,* spray with ten pounds of lime, six pounds of copper sulphate and forty-five gallons of water, just as the buds are swelling; *second,* spraying just as the bloom clusters break open, but before the flowers expand, with four pounds of lime, five pounds copper sulphate and forty-five gallons water; and *third,* treatment when the fruit has attained the size of a hazelnut, with the same formula, in which four ounces of paris green is to be added for the codlin moth. For curlleaf on peach and apricot, bordeaux mixture; spray six weeks and again three weeks, respectively, before buds open in spring. For codlin moth, four ounces of paris green, two pounds of lime and forty gallons of water or assenite of soda solution has been found most satisfactory. For woolly and green aphis, four pounds of resin, two pounds sal soda and fifty gallons of water (must be boiled); or tobacco and soap wash, viz: Tobacco (sheep dip, sulphured tobacco), four pounds, whale oil soap four pounds, water twenty gallons. And last, but not least, San Jose scale, greedy scale and turtle-back scale: Sulphur, lime and salt, or sulphur, lime and blue vitriol.

All orchard trees should be sprayed in the fall as soon as the leaves have fallen, whether diseased or not, as a precautionary measure, with either sulphur, lime and salt, or a wash consisting of lime, 15 pounds, blue vitrol, 6 pounds, water, 45 gallons, for that is the time when the spore clusters of the fungi burst open and are carried by the wind hither and thither. They find lodgment on every tree, and if there is a crack or abrasion of the bark they will at once fasten themselves there, strike root and begin to grow. As these sprays kill by contact and in order to destroy these spores and prevent their deadly work, it is advised, in fact imperative, to spray at that time. *But under no consideration should trees be sprayed while in bloom.* Many of these washes require very careful preparation in order to be effective and some have to be thoroughly boiled to properly combine the ingredients, otherwise much of their effectiveness is lost.

"After five years' experience in spraying with insecticides and fungicides," says Professor Lodeman, of the Cornell experiment

station, "I am sufficiently satisfied to plan for the future to do the work more thoroughly than it has yet been done."

Professor Green, of the Ohio experiment station, in speaking of scab, shot-hole fungus and pear blight, says: "It is desired to draw attention to and emphasize one important fact, viz., treatment with fungicides is preventive, not remedial. After a fungus disease has become established it cannot be cured but it can be prevented if preventable if treatment is begun in time. Hence, it is important that the first application should be made early, generally before the leaves open or soon after. It is too late to begin making applications of fungicides after the disease has made its appearance." So important he considers this that he further says: "It should be remembered, also, that it is not always possible to wait for pleasant weather when spraying is to be done, but if good results are to be secured the work cannot be delayed for any considerable length, hence, it often becomes necessary to spray just before or soon after a rain. In short, nothing short of an actual rainstorm should stop the work when the time comes when it should be done. Properly prepared mixtures will stick to the limbs and foliage even through hard rainstorms, provided they have half an hour in which to dry. Cloudy weather, or the appearance of rain, should not hinder the work." There is no longer any question as to the efficacy of spraying for diseases, but it has also been proven that the color and size of apples at least is enhanced. The profit to be derived from spraying orchards is very considerable. The fruit crop of our state would be enhanced in value by several millions of dollars annually if the practice were generally followed.

Here the question forces itself upon one's mind, how are we to reach best results? And the answer follows, through thorough

HORTICULTURAL EDUCATION.

Hon. J. H. Wilson, of West Virginia, said recently: "If I had the money I could see no better way of advancing the interests of the town I live in than by establishing an industrial school. Instead of mechanics, we have persons in every trade that are not fitted for any special class of work. Instead of system and ability, we have the opposite. The common school system gives knowledge of a certain class that cannot be used to advantage toward securing a living. It fits a few teachers, a few clerks, a partial foundation for the majority, and by that majority not used until forgotten, and a loss of a certain number of years is the result. What is needed is an education that will fit the majority to secure a good living, to perform their labor in an efficient manner, to do work that will not only pass, but will be

commendable. It is a usual rule to send a good mechanic out with a number of poor workmen, persons who have not learned the trade, or are capable of learning it. The consequence is poor work and dissatisfaction. A poor mechanic will take longer to do the work, besides doing inferior work, and often entirely ruining it. What we want is concentration, the best work in the least possible time, and only thorough training with competent persons will secure this. Competition is so close that it is absolutely necessary this result be reached."

This applies equally to horticulture, but it is not the work of individuals, but a paramount duty of commonwealths to furnish an education that will fit the majority to secure a good living, and as Oregon is an agricultural and horticultural state, and the majority of its inhabitants farmers and fruit-growers, we need instruction in our common schools which will educate in that direction. I know of young men and women attending our public schools studying Latin and Greek, who do not know an oak tree from an elm, nor growing oats from rye. It is far better for them to study the language of nature, and some of its living laws, than waste their time in studying dead languages. Education is vital, not formal. Sooner or later will the consciousness of this truth come to them—usually it comes too late. Do not think me opposed to education that educates; on the contrary, no man believes in a more thorough, practical education than I do, but there is such a thing as over-education, as over-cultivation in an orchard. Many a boy who would have made a good farmer or fruit-grower with the proper agricultural and horticultural education, has been diverted from the path of usefulness laid out for him by his Creator, by a smattering of Latin and Greek. Brains are as essential on the farm and in the orchard as in the office or counting room. When Meissonier, the great French artist, was asked how he succeeded in painting such beautiful pictures, he answered: "I mix my colors with brains." In an editorial of recent issue in the Oregonian, headed "Brains in the Workshop," this point was made very clear, and in summing up it said: "The way lies through intelligent investigation of markets and methods, and the application of brains to agricultural and horticultural problems. We must study to please the tastes and notions of the world's consumers, and we must avail ourselves of the researches of the biologist, the bacteriologist, the entomologist, and the investigations of the expert in crop and market conditions. Uninformed and unenlightened labor is at a great disadvantage in these days of sharp trading and of scientific adaptation of means to ends." Here we encounter one of the great problems—the lack of horticultural education in our common schools. True, the

professors of the agricultural college, the commissioners of horticulture, aided by the press, are doing all in their power to educate the fruit-grower, but such education should have a solid foundation and begin in the schoolroom; and it is to be hoped that the day will not be far distant when agricultural and horticultural education will form part of the common school curriculum, and we will have an agricultural college in every county.

I have spoken on this subject repeatedly, and at one of our recent meetings of the state board of horticulture I made the motion, and we passed a resolution, requesting the board of education to introduce into the public schools of this state a rudimentary line of instruction in horticulture, as the essential elements of an education, to fit men and women for intelligent labor on the farm and in the orchard. I have no doubt that this will be done; it is becoming pretty thoroughly understood that our state is a horticultural one, par excellence, and the trend of affairs shows the migration from the city to the country, and a thorough horticultural education is absolutely necessary to become a successful fruit-grower. A notable instance, to illustrate, has been brought out in an editorial of the Oregonian: "An argument for textile schools is found in the growth of German woolen manufactures. Germany's sheep decreased between 1860 and 1890 from 28,000,000 to 13,500,000, but its number of woolen and worsted spindles increased in the same time from 1,665,759 to 2,600,000. When the English sent an expert commission over to learn the cause of German ascendency in textile manufacture, the conclusion arrived at was that textile schools accounted for it." Now, when a great country like Germany finds it profitable and necessary to establish schools for special purposes, and another great country like England finds it necessary to appoint a commission to inquire into this state of affairs, it seems to me that we could readily profit by it and petition the governor and legislature to see that agricultural and horticultural education will form part of our public school curriculum.

CONCLUSION.

Horticulture, as we understand it, is no longer the problem it was, thanks to the scientific investigations of the professors of the experiment stations throughout the world and to practical fruit-growers. Wo know the soils best adapted for various fruits, the best varieties to plant for family use or commercial purposes, and know how to evaporate them. We also know what varieties to plant together for pollinating purposes. We know the diseases and insects infesting trees and fruit and how to combat them. But the marketing of our products to advantage is the

greatest problem that confronts us. There has been written and said a great deal on this subject, much of which is true and much false. After a good deal of study and careful consideration, I come to the conclusion that coöperation is the only way to solve it. When evaporated prunes, for instance, are selling as they do now in the eastern markets for ten cents per pound, and our growers are paid only three cents per pound packed in 25-pound boxes delivered f. o. b. cars, and we know it costs only one cent per pound to carry them to Chicago, New York or Boston, making four cents per pound in all, we can readily see there is something radically wrong somewhere, which *must* be righted. Where does the difference of six cents per pound go? Echo answers, where? It is absolutely necessary to bring the producer and consumer closer together, so the former will receive remunerative prices for his products and the latter will not have to pay exorbitant figures.

I said that fruit-growing was not only healthful but more profitable than any other agricultural pursuit. On careful inquiry in my district I found that those farmers who had fruit to sell always have money to purchase the necessaries of life and even luxuries.

Manufacture will surely increase in Oregon and our mining interests will be largely developed and help to bring about good times, but Oregon is a fruit-growing state par excellence.

When the framers of our constitution adopted the motto "*Alis volat propriis*" (she flies with her own wings) they unquestionably had the future horticulturist in mind, for success without fruit is impossible. The intelligent progressive fruit-grower of the present day must furnish the "wings" to place our state on that plane of continued prosperity, unaffected by the manipulations of speculators, politicians, goldbugs or silver maniacs.

In conclusion, I would kindly ask you to bear in mind that there is more profit on a small farm, well and intelligently tilled and cared for, than a large one at haphazard. Permit me to quote from Pope, who says: —

Happy the man, whose wish and care
  A few paternal acres bound,
Content to breathe his native air,
  In his own ground.

Whose herds with milk, whose fields with bread,
  Whose flocks supply him with attire,
Whose trees in summer yield him shade,
  In winter fire.

Blest who can unconcern'dly find
  Hours, days and years glide soft away,
In health of body, peace of mind,
  Quiet by day.

Sound sleep by night, study and ease,
    Together mixed; sweet recreation,
And innocence, which most does please
    With meditation.

Thus let me live, unseen, unknown,
    Thus unlamented let me die;
Steal from the world, and not a stone
    Tell where I lie.

HORTICULTURE IN EASTERN OREGON.

By John E. Hough.

This is a very fast age; it is an age of railroads, electricity, politicians and other smokeless powders; it is an age of development and expansion, progression and economics; and it matters very little to the average Eastern Oregon citizen whether the seductive fruit that Mother Eve used to tempt Adam with, was an apple or an orange; whether Pliny preferred strawberries or pears. But it does concern us very materially as to the kinds of fruits and varieties of each that can be grown here; and more especially does it concern us as to the kinds and varieties most susceptible to our soils and climatic conditions; the kinds that will bring early returns, find ready markets and that can be produced cheaply. Eastern Oregon is generally conceded to be a "bunch grass" country; a sheep, horse, hog and cattle paradise; but the horticultural possibilities are beginning to force themselves to the front.

There are few sections in Eastern Oregon where the farmer cannot grow an abundance of all the hardy deciduous fruits, and in many localities the most tender varieties of fruits for his own family supply—and in greater variety and profusion than in any of the eastern states. Apples, pears, cherries (both sweet and sour), prunes, plums, apricots, peaches, nectarines, red, yellow and black, raspberries, blackberries, dewberries, juneberries, gooseberries, currants, strawberries, tomatoes and mulberries, with asparagus, beans, peas, beets, celery, sugar beets and the whole category of a full-fledged seedman's catalogued list of vegetables, all on the same tract of ground, is not to be found in the east; but here you find them all in the farmer's kitchen garden. On these we have passed the experimental stage, and are now casting around for specialties which have the most commercial value. We want to raise that from which we can realize the most profit. Economy of production, freights, demand and time to wait all enter into the same proposition.

Location, soils, climatic conditions, cultivation, the kinds of fruits, varieties of each, the marketing, freight and many other things are to be considered. There are many specially favored

localities where commercial fruit-growing has proven to be a success, one of which, gentlemen, is almost under the shadow of this building. The requirements are: Suitable soil, of the proper texture, available moisture, either natural or from irrigation, currents of air in springtime to prevent frost, and the trees should bloom late and the air dry enough in autumn to fully mature the wood and buds to prevent winter killing; and I do think that we have more of these so-called thermal belts in Eastern Oregon than elsewhere, especially east of the Blue mountains, and I would ask you individually if any of you can refer me to any section in your native states where there are any orchards planted 34 years ago that have not had a failure of apples, pears, cherries, prunes, plums, etc. Of course, some years we have larger crops of fruit than in best favorable seasons; but while one man's crop is below the normal, his neighbor's, if planted at a different date, is above the average; while the only fault is a tendency to overbear, which is not objectionable to a practical orchardist.

CLIMATIC CONDITIONS.

I will not attempt to explain the whys and wherefores; it is sufficient that we have the conditions, and the proof is easily demonstrated when you see strawberries shipped from here to Omaha and Kansas City without ice in a common express car opened at every station and not a single crate reported spoiled in three seasons' shipments, apples frequently at the Eastern Oregon fair that are two years old, and this season Italian prunes shipped to New York and Boston, selling there for from $1,100 to $1,300 per car, netting the grower from $60 to $70 per ton on the trees. Such prunes would not be obtainable if the soil and climatic conditions needed doctoring.

CULTIVATION AND IRRIGATION.

While there are many sections east of the mountains where irrigation is not at all necessary, there are also sections where irrigation is necessary. I find that on my own place irrigation is not needed and think I can show as fine cherry and apple trees as anyone, I have never used any water although I have an abundance of water if it was needed. I find that thorough cultivation is very profitable and would recommend deep plowing before and the first year after planting, to induce the roots to go down, afterwards shallow cultivation and no plowing with a turning plow to make ridges; a Planet Junior cultivator passed over an orchard every two weeks will produce the result you can see at our orchard. When I say two weeks I don't mean a

month or five weeks; if the cultivator is started every alternate Monday morning you will have no hoeing or weed-pulling.

I do not think it advisable to impose upon or try to rob nature by raising other crops between trees of an orchard. It is not profitable to impose on nature. All farm or garden crops have a tendency to rob the trees of their food, which in this country is principally moisture. If you are skeptical on that point please experiment and report.

If you think fruit raised by irrigation is of poor flavor, experiment on that line and be convinced. It matters not whether moisture is applied by irrigation on the surface, by sub-irrigation or whether it is done with a cultivator, sufficient is enough and excess is "too plenty." Intelligent application of moisture will produce good-sized, high-colored, fine-flavored and good-keeping fruit.

As some are not yet believers in cultivation producing moisture it is easily proven; thus, for instance, in dry weather when the ground is as dry as it seems possible, go into a shed where no rain has fallen for years and dig and finely pulverize the soil and repeat the same process daily for ten days, then write a piece for your horticulture paper and scientifically explain whether this moisture under the shed, produced by cultivation, was caused by capilliary attraction or whether it came out of the air or if it was the sweat from your brow; but the moisture will be there all the same. I notice that many who have facilities for irrigation depend too much upon irrigation.

After irrigating, an orchard should be c ltivated both ways, and by following the irrigating with the cultivator much better results will be obtained, less water needed, less weeds and larger and higher colored fruit of much finer flavor.

KIND OF FRUITS.

The apple seems to be the universal fruit of Eastern Oregon and there are large sections of land suitable for the profitable growing of commercial apples. All the foothills and many of the river and creek bottoms, as well as numerous prairies, are well adapted to apple culture and the early bearing and smooth, sound fruit raised here clearly demonstrates the fact.

The high valleys produce the latest keeping and most solid fruit, and pears of all varieties seem to do exceptionally well in most if not all of the apple belts. Cherries are raised in great profusion and the sour varieties or Mahaleb stocks, which are the same as raised in Iowa, Nebraska, Kansas and Illinois, do exceptionally well and to men from those states just mentioncd are marvelous, indeed.

But our sweet or commercial cherries are entirely different from those of the Duke, Morello class. In Grande Ronde valley we find the Eden garden for sweet cherries and the inhabitants are fast awakening to the fact that in many sections the sweet cherry is the most profitable commercial fruit, and at La Grande, Union and Cove are commercial orchards which will soon astonish the world.

Our cherries here ripen in August and September and go into the eastern markets without competition and very high prices are realized; as a case of cherries only weighs 10 pounds the freight is light, and they can be sent by express to any market, and, like millinery goods, it will stand express charges with plenty of margin left. For the high valleys winter apples, pears, cherries, prunes and plums seem to be the commercial fruits, and for the lower valleys the peach, where transportation is available, is certainly the most profitable fruit. The Imnaha, in Wallowa county, Snake and Burnt river valleys in Baker county and Eagle valley in Union county all produce peaches that cannot be excelled in any state, and they have the keeping qualities that makes them of great commercial value, while other sections raise good-sized and juicy, luscious peaches; they are too juicy for shipping purposes.

VARIETIES OF FRUIT.

To the amateur apple orchardist I would say, be careful; first, select your location near a good orchard section and wait to experiment; don't plant to suit your individual taste, and if you, when a small boy, stole apples from your neighbors on your way to Sabbath school to eat while your lady teacher was admiring the minister, don't plant that same variety; your taste was, no doubt, imagination. Go to a fruit-shipper, a fruit-dealer or a cold-storage man and consult with them, and if they speak of many varieties hunt others; select a variety that suits your individual locality, that bears young, that does not windfall, that does not split and break, that will stand transportation, that will stand refrigerator heat or sweat, that will stand cold storage, that is wanted for export, and select any color you like, so it is red, and leave the matter of flavor to be passed upon by the fellow who eats it; and of the first 1,000 apple trees you set out, plant all of this variety and stay with it; don't change your notion. Do the same as in your politics; study first and don't change unless you change your political belief; be sure to stick to the nominated variety.

Of the varieties of apples raised in Eastern Oregon for shipment, I would select from the Gano, York Imperial, Rome Beauty, Jonathan, Willow Twig, that is for the higher valleys, and if

planting on the low, warm valleys I would choose the Newton and Spitzenberg; be very careful about new varieties; let the other fellow experiment. The Shackleford apple which was highly recommended here a few years ago by the book cranks has proved a failure, and is not late enough for the holiday trade and half of them are on the ground at picking time; hundreds of trees here in my own neighborhood will have to be worked over. The most dangerous apple pest we have here is the "new variety crank"; he is apparently a hybrid between an encyclopedia and a red-backed catalogue; the only remedy for this human pest is a large, long dose of deep bitter-rooted experience.

PEARS.

We are something in the experimental stage with pears, yet here I got out for Eastern shipment this season the first straight carload of pears; they were all Bartletts and brought fair prices, and for commercial pears, all thing considered, I would nominate the Bartlett; they can be raised and delivered at the packing shed for about $5 per ton, and as our Bartletts ripen here in Grande Ronde in September, there has not been a season for the last eight years that shippers would not have been very eager to buy at $20 per ton. As they begin to bear here at two years old in the orchard, 400 per cent. is surely enough for the grower.

VARIETIES OF CHERRIES.

The Royal Ann, Black Republican, Bing, Centennial, Lambert, Oregon and Hoskins seem to be the prevailing varieties in the commercial orchards.

I have only four varieties intended for shipment. I have 22 varieties, one of each sort, for experimental purposes. Of the older varieties, Royal Ann is planted the most extensively.

The Republican is inclined to overbear, but by thining with grape shears they are the finest I ever saw, but the trees are inclined to have too many dead limbs; so I have the Republican in the experimental orchard. Tartarian and Centennial, as grown here, are solid and will ship as far as desired, while the Bing and Lambert are as fine as could be expected; the Hoskins is also a beauty, but these new varieties are not yet old enough to be thoroughly tested. Royal Ann trees are still bearing here that have never had a total failure for over 20 years. There is a new kind here, known as the Grande Ronde, being introduced by A. I. Gale, of Union, Oregon, that has especial merit, being an excellent shipper, blacker than the Republican and much larger, ripens with the Tartarian and should be in every collection.

THINNING, PACKING, MARKETING.

There is nothing that will pay the orchardist as well as vigorous thinning; it matters not if it does cost you as much as it would to harvest your crop. It applies to all kinds of fruit and to all sections. Grape-growers have recognized this fact many years ago, but orchardists are slow to take hold. If properly thined the packing is a pleasure, and it should be borne in mind that a carload of fine, fancy fruit is better and of more money value than a trainload of second-grade fruit. The packages should be neat, clean and attractive; cheap packages are the most expensive, and as to the marketing it should be borne in mind that no one is so far from market as the one who has nothing to sell; and if you have enough of fancy fruit the buyer will find you. This season the Armour Cold Storage Company secured the most of the apples here and a dealer in Birmingham, England, offered to come here and pack if guaranteed a hundred carloads of clear, smooth, fancy, red apples; he was willing to take his chances on the prices; quality and quantity sufficient to justify were the only requirements. There is no question about the marketing; they will sell at home if you have the right kind of stock and I venture to say that 20 years hence fancy fruit will bring 20 per cent. more than at present. Such at least has been the history of our markets for the last 20 years and the conditions are now much more favorable than they were 20 years ago and history is sure to repeat itself.

WALLOWA COUNTY FRUITS.

The general impression is that Wallowa county does not or cannot raise fruit, but I notice that L. J. Rouse captured many premiums at our Eastern Oregon agricultural fair at La Grande this season, and with better railroad facilities Wallowa county will, no doubt, come to the front as a fruit-producing county.

BURNT AND SNAKE RIVER.

The Burnt and Snake river valleys of Baker county have been raising and shipping fruit for several years; their principal market is Denver, and stands second to none in that discriminating market.

THAT BIG APPLE.

Only a few years ago the whole state of Oregon was wild with excitement over capturing the prize for the largest apple at the Chicago Columbia exposition, in competition with the whole

world. That apple was a seedling and the tree still stands in Eagle valley loaded every year with bushels of apples just as large and fine as the one that captured the prize at Chicago. The Eagle valley people think they can beat the world on apples, and they seem to have the proof that they did do it and have over half an inch to spare; the conditions of soil, climate, etc., seem to need no fixing in that favored locality.

SHIPMENTS OF FRUITS.

From Grande Ronde valley nine years ago on the twenty-seventh of December I shipped the first carload of fruit from this county; it was of winter apples and they were raised at Cove, Union, La Grande and Summerville.

There was an apple dryer in operation at La Grande this season; although they did not get started in time to use any summer or fall fruit, they worked up 850,000 pounds of green apples besides shipping fifteen cars of green apples and a carload of 30,000 pounds of peeling which were dried and shipped to St. Louis to be made into "currant" jelley and shipped back to Portland for distribution in the northwest. There were 1,185,125 pounds of green fruit shipped from Union county in car lots this season, besides the local shipments to mountain towns and the express shipments which are not included, and 72,850 pounds of evaporated prunes and apples, while the output of evaporated prunes I have not yet obtained the figures. Green prunes coming in here after the markets are bare are too valuable for drying. There is a large Allen evaporator in the cove, but I have no figures of their output.

PROFITS OF FRUIT-GROWING.

This season, from an orchard of Gano apples, 5 years after planting, was obtained $4 per tree, which, at 70 trees per acre, would make $280 per acre, and from an orchard of 15-year-old Willow Twigs $15 per tree was realized, which, at 70 trees per acre, would be $1,050 per acre. The largest yield of any one tree of which I have personal knowledge was 42 bushels of marketable apples. They were of the Waxen variety and sold for 75 cents per bushel.

EASTERN OREGON'S FUTURE.

With judicious legislation fostering the beet sugar and similar industries; with an "open river" to the sea; with the Nicaragua canal; with our national territorial expansion; with the new

era of railroad construction; with the many advantages of soil, climate and healthfulness, and with an individual and united effort upon the part of the people, there is little room for a doubt that the "red apple inland empire's" horticultural interests, as well as the other diversified interests, will be found in a healthful condition, and the population and wealth of Eastern Oregon will be materially increased. There is surely a bright future for the northwest, especially for Eastern Oregon.

HORTICULTURE FROM A HYGIENIC AND ÆSTHETIC STANDPOINT.

By MARGARET P. SNELL.

Ladies and gentlemen visitors, and citizens of Corvallis:—

The occasion which calls us forth at this season of "mellow fruitfulness" I think we must all look upon as a very interesting and homelike one, with something of a cheer in it, with which we gather around the evening hearthstone and tell stories and roast apples, and though, perhaps, there are not many outside the horticultural society who would claim to know much scientifically of the pleasant subjects under discussion, yet, I think there are few who would admit that they did not know as a familiar friend the flowers smiling up at them from the garden walks, or the vegetables in the back dooryard waving their green tops, odorous of dinners yet to be; and the fruit trees in the dear home orchard, let them torture themselves into very dragons in shape, who does not know and love them also, and cherish them as a brother in his heart. We have all doubtless noticed in the summer gone the procession of flowers as they passed, and were not unmindful of the transformation going on in the trees around us, from the time in the early spring when the sodden winter branches broke into starry bloom, until later, passing down the year, we have seen them laden with golden, green and purple buckets of nectar, drawn from those inexhaustible vats in "the deep delved earth," or from the viewless cisterns of the upper air. And now that Oregon fruits have traveled far and wide, and are "still blushing with the praise of their own loveliness," how appropriate it is to the occasion that those from whose orchards they near have gone forth should assemble and mentally exchange with each other the fruits of this year's experience. By these frequent meetings in time a knowledge of better methods in horticulture will have been distributed as the fruits of this season's labor, over every hill and valley of our state, and these will return to us again, the echo of the hours almost gradually given to these gatherings in fruits of better quality and finer flavor.

Though there is much necessarily which must be said by the orchardist in all that pertains to the cultivation, spraying and ingathering of fruits, yet should he stop here it would be to linger on the porch of the subject; the house has yet to be entered, that for which seed time and harvest stand, culminates within doors, and even more interiorly, within the man. Let us leave for a time all this outward show and necessary activity and reason together on what this muscular labor in tree and garden culture means, what this sweat of the brow stands for.

Dollars and cents come back in a chorus of voices. Yes, certainly, but our labor was shorn of its dignity. Was this all? Wholesome food for the world, several reply. Yes, truly, and this is a very satisfactory result of our toil. Adorning the home grounds and exchanging baldness for beauty, faintly responds a woman's voice. Words, prompted we doubt not, from the same inner vision of the value of things which made the poet sing "Beauty is truth, truth beauty, like birds on the wing," these several answers carry us over in contemplation to viewing our material and spiritual relations with dear old mother earth, who, though centuries old, is ever young; and reaching out to us glad hands, in the green trees growing, and springing bush and herb.

Labor for her, and like a human thing, she will respond to your loving thought and care. What inspiration it puts into work, to know that the force expended in turning and overturning the sod, with plow and harrow, in mud and rain, will for the horticulturist, on some other day, be caught up into flower and fruit. That the song full of immortal energy, the picture glowing with eternal beauty, has been executed through the power lifted up from the sod by the producers, giving wings, as it were, to our apples, our pears and our prunes by this service to thought. Oh! young student, farmer and horticulturist, if there are any present, rejoice that your lot is to be cast out of doors; that your work is to be in the great crystal palace of the world, whose walls are as many hued as the gates of the apocalyptic vision, whose roof reaches up to the throne of God, from this realm, in which you may one day labor, nearly all the wealth of biblical and poetic lore is drawn. From this fountain of fresh life, ever springing, comes in snatches through windows and open doors, the influence that sweetens the daily toil of the housewife plying her daily task.

For tired men and women, from countless stores and offices, from factories and schoolrooms, there is refreshment also, when they close the door on the little devices of man's invention and pass into the outer largeness and behold God walking among the flowers and trees.

Do you seek a life within doors? Seek it not. A right long

time awaits us all for that, in earth's tombs and charnel houses. What is along with all the "sweetness and light" of the outer world? There is hard work and exposure to wind and weather; this buffeting of mother nature is an effort on her part to do for "her foster child her innate man," what Mr. Cruncher bitterly reproaches Mrs. Cruncher for not doing, by her motherly oversight, for their spare, half developed son, Jerry—to blow you out into a fuller, nobler type of manhood, than can be developed under roofs—and let me ask you to enable this work of yours, that is to be, by putting more thought into it, by doing it better and so getting more beautiful and satisfactory results. It is the noblest work this world has to give to the young man, getting his development—this work with nature. When the inner world of the mind and spirit needs you, and you are ready for it, do not fear but she will find you, if you are a noble man; the farm machinery cannot hide you, the shade of your fruit trees cannot grow so dense that you will be obscured.

The great men of the world or a large per cent. of them, have grown up with nature. Christ chose not scribes and teachers to carry on his work in the world, but men who had bought it, who had dipped in the salt sea brine, whose faces were weather beaten by land breeze and sea breeze, who had about them the freshness and purity born of an outdoor life. And there, too, there was David, beautiful shepherd lad, "ruddy of countenance, called from the pastures of Judea, to serve in court and temple."

Stand up before your work with an attitude, as before a sublime thing.

Do not let your knees shake, when men get up and give you advice with (you know the tone), a sort of half pity that manual work must be done, and that it has fallen to your lot to do it, "but on no account to let the work of your hands absorb your brain powers." Instead, they should tell you to be such an enthusiast in your manual employment that all mental powers will be called forth to accomplish it successfully.

Are not the fields of black loam immense blackboards where you are constantly to be figuring from morning to night? And no farm or horticultural work is well done that does not tax your mental powers greatly; and almost equal to working out integrals in calculus is to make ends meet in hard times like the present. Do not be intimidated into thinking you have made a mistake in choosing horticultural studies, and that it would have been better to have selected those leading up toward the professions.

Just stop a moment and lay out the measuring line of farm or horticultural life against them. You will find that in that which makes for the peace and nobility of life, if you choose to extract

it, the measure will encompass most of them again and again like a shawl strap.

To you elder horticulturists, that are and have been gardeners and fruit-growers these many years, I wish to remind you of the blessing you enjoy in that your arboreal labors, unlike those in many other lands, are health-giving and wholesome. You are not rising early and toiling late to rear those little, wrinkled demons that spread their fragrant blankets in the bottom of so many teapots, breaking down the nerves of Christendom and destroying that beautiful and lofty repose of thought and manner, which should characterize men and women laying claim to the mighty title "Sons of God." The cancerous contents of no coffee urn can point to you as their tumerous progeniter. You are not digging and delving that the products of your labor may go to swell the widespread stream of tobacco spittle that courses east and west through our land with mighty tributaries from the southern states and bayous, penetrating even the sacred precincts of the home, making necessary that dark blot on the family escutcheon—the cuspidor.

Happily the trees and plants you are helping to grow in such abundance have about them the fragrance of heavenly food; and at the same time, while they are furnishing us with light and pleasant eating, their juices are essential to the maintenance of health, and keep at bay sickness, one of the most formidable kinds of which shows itself in the languor and general debility of scurvy. The results of Dr. Parker's investigations are of hygienic value, and being brief are shortly summed up. He states that it is difficult to decide on what constituent in the complicated mixture which we take as food, it is due, that normal health is maintained; but this is positively known, that when the system has been deprived for some length of time of a sufficiency of those salts whose acids form carbonates in the system, languor and general debility ensue. Most of these acids come from the horticultural realm; they are citric, tartartic, acetic, lactic and malic. They have great value in allaying inflammatory tendencies, and when we consider on what slight causes the blood may run up to fever heat, with its signal fires burning in the cheeks and lighting up the eye, we cannot value too highly the powerful ally we have in the acids of fruits.

Under their beneficent agency the fire in the blood is quenched, the heart's pulsations are slowed, the pulse beats more rythmically, nature recovers her equilibrium, the light of health returns to the eye, the song of joy to the lips, and the work of life goes on.

Every tree planted on your place is a leafy sanatory, taking to its umbrageous growth the hurtful exhalations, purifying the

air, sending out also on every passing breeze the life-sustaining oxygen, that mighty, invisible, silent force, at once the angel of life and the angel of death in the physical universe.

I would like to speak of gardening as one of the most charming and wholesome occupations a woman can engage in to recover failing health and to maintain it. Better than many tonics is it, to go into the spring sunshine and feel the new life thrilling through the finger ends as one crumbles the rich, dark loam for the garden seeds. I believe half of the delight which was felt for the old fashioned garden cf our childhood, was due to the atmosphere it breathed (in its look of happy rest among the plants) of a woman's loving personal care and attention, and until we get our farms reduced down to an acreage, that it is possible to reach over with this personal loving care, the earth will not, in the language of David, "bring forth her increase, and God, even our own God, give us his blessing." The look there is of an old jaded horse that has been ridden to death to get all the money possible out of him with no loving thought for the animal, is too much the appearance of what we call our land. This being our subject (already too long), to which much might be said on putting more of the spirit of beauty into our work, more of that which appeals to the inner man. It cannot be; it is not time, I am sure, of any in this audience, the imputation that our spades and shovels are often bright, with never a gleam won from turning the sod in the home yard in the service of beauty. And yet this evanescent, this intangible something that we cannot measure by the bushel and sell, can't tip its weight on the scales, is "one of the great powers in the world that tends to build up human civilization," one of the claims made by the necessities of our nature, "which man must satisfy if he would be humanized."

Do you wish to keep your young people from flocking to the cities? Then make of your farms alike to beauty as well as to gain; and daily sacrifice thereon a little time and a little money; then shall there go up for you, from embowered arbor and a screened trellis, from vine arched gateway and peaceful flower beds, not only the incense that shall sweeten the daily toil, but you will be giving to home and its surroundings that magic touch which makes celestial sea and land.

EDUCATION AND PROTECTION.

By Hon. H. B. Miller.

The underlying principle and foundation of all social laws is protection.

The secondary rule of societary law is selection and cultivation.

Protection is afforded by various methods of police regulation.

Selection of industrial forces in society must come through educational channels.

Horticulture in its broadest sense is one of the great elements in modern civilization. Society without horticulture would be dull indeed. Mechanics, art, literature and various shapes and forms of science are adding immensely to the ease, joy and pleasure of life, as well as laying the foundation of a powerful and progressive civilization; but, among all the forces that are active in our national growth, horticulture stands in the front ranks. To an association such as this it is needless to recount in figures the vastness of the industry, and the marvelous magnitude of its growth.

Industry is the foundation of our social growth and the variety, diversity and extent of our industrial life are the true measures of our civilization. Our intelligence and morality are developed through our industrial forms of activities. Some one has well said that it is activity and not precept that develops, and I am a firm believer in this doctrine. The characters of men are moulded by their industrial occupations, and that of their ancestors. Our prison statistics prove that a large per cent. of the inmates of these institutions have had no special trade or occupation; have been untrained in industry. If industrial life is the groundwork of our modern civilization, if industry is the soil that nourishes and produces and sustains the tree of our national greatness, if all the elements of our character and power do come up through the varied forms of our industrial activities, then I maintain without fear of contradiction that horticulture is one of the prominent factors in our social growth and positively essential to our best development.

Whatever may be the future state of man or society, so far as this world goes, today nations are measured by their industrial activities, by the variety and extent of their wealth-producing

capacities. The relation of horticulture to society and the laws necessary for its protection and development are problems of interest and statesmanship that we cannot afford to neglect.

PROTECTION VERSUS CIVILIZATION.

Let us first examine the relation of protective laws to social growth. We have many able and conscientious people in this country who are firm believers in the "*laissez faire*" philosophy of government, earnestly opposed to every form of protective law, claiming that they are an interference with personal rights and liberties, and detrimental to social growth. Unfortunately for the interests of horticulture we have many believers in this doctrine who have orchards in Oregon. In Southern Oregon especially I have found many good orchards being entirely ruined with San Jose scale and apple canker and their owners refusing to do a thing to stop the spread to their neighbors' orchards, and opposing with a savage determination any interference on the part of society to protect itself against these injuries. We will be best able to fully comprehend the necessity of protection as an element in civilization by examining the subject from the standpoint of horticulture. Anyone who has made a study of the peach realizes full well how much care, cultivation, fertilization and protection in various forms are required to keep it from reverting to the almond, from which it is supposed to have been developed. The grape has a strong and everlasting tendency to reversion to its wild form. The rose, no matter how lovely in fragrance, form and color, requires constant work to keep it in its highest civilized state. The apple, with its thousand varieties, if uncared for in a few generations runs back to the wild crabapple; the pear to wild pear, and so it is with every kind of plant. The universal tendency of all plant life is to revert to its wild type.

The let-alone policy, if applied to plant life, would give us no higher form of vegetation than the wild savages enjoyed. Industry and protection are the watchwords for the maintenance of the civilized vegetable world. The same principle is true of the animal kingdom. Every type of domestic animal life, if left to nature's care, reverts to the original form whence it had been brought by man's skill and protecting care. The great diversity and variety in vegetable and animal life that is the product of untold ages of man's ingenuity and fostering protection, would soon return to a few simple wild types were we to let nature have its course. Simplicity and uniformity are nature's stamps upon the vegetable or animal, while complexity, diversity and variety are the human, social stamps on the world of man's products.

Variety and diversity are the measures of all forms of civilization. Compare the varieties in form, color and perfume of the wild rose with the cultivated, or compare in the same way the apples, pears, grapes or any kind of fruit or vegetable, and this one fact of variety being the essence of the difference between the natural and cultivated plant, will become clear. The same comparison among animals will convince you of the singleness in type of the wild, untamed animal world. A casual examination of man himself along this line proves the same thought.

EDUCATION AND PROTECTION.

Examine the eyes of the lower orders of man and you will find them of uniform color and characteristics, while the highest civilized people have gray eyes, blue eyes, black eyes and brown eyes. Examine the hair of the Indian, African or Chinese, uniformly straight and black in the first, curly and black in the African, and straight and black again in the Chinaman. Whatever it may be among these lower races, it is uniform.

On the other hand, examine the hair of the highest form of civilized men and we find black hair, brown hair, light hair, auburn hair, red hair, curly hair, straight hair, and in many instances no hair. Whether or not the latter represents the very highest form of civilized man I will not now stop to discuss.

Examine the subject from any standpoint, you will find this fact universal—that variety and diversity in industrial life throughout the vegetable, animal or scientific world make the true standard of social civilization. Societary laws are not to be based upon the "*laissez faire*" theory, for that destroys our civilization by annihilating variety and establishing uniformity. The fundamental rule of social law must be preservation and protection of the best. Our city, county, state and national laws of health are founded on protection of the healthy against the unhealthy.

The entire system of our criminal laws is based upon this same principle of protecting the honest man against the thief, the moral man against the immoral and vicious. Society does then not exist by the rule of survival of the fittest, but rather by the protection of the best.

Society has the power of selection and is responsible to a great degree for the nature and character of its organization. Horticulture, then, being an acknowledged element of great virtue in man's social welfare, must be recognized in our laws, and protection of every kind necessary to its growth and development must be provided and maintained if it is to live and prosper. What I mean by law is not merely written statutes but the true

knowledge of their worth and virtue and a spirit to maintain all laws essential to our social growth.

We have horticultural laws in Oregon and yet I doubt if there is a state in the union where injurious diseases and pests are doing more damage, and at the same time being combatted less, than here. Of 100 apple orchards visited this fall only 10 had been sprayed and all were infected with either scale, apple scab, canker, moth or other forms of disease and pests. The loss to the state this year by these enemies was not less than $150,000. Throughout the Willamette valley the loss of the apple crop was not less than 75 per cent. In the face of this dreadful economic waste many persons are found who absolutely refuse to spray. The lice, scale and fungi may annihilate horticulture as far as these farmers are concerned, and still they will not raise a hand to protect our civilization.

If their bodies become diseased, the law quarantines them. If they are covered with smallpox or leprosy, they are restrained from association with their fellow-man. Horticulture has no more chance to live unprotected than man can live without protection against dissemination of disease, and any man who plants or owns fruit trees and allows pests and diseases to be fostered there, is as much an enemy to modern society as though he deliberately carried smallpox to his neighbor's home. He has no more social or moral right to foster the one than the other.

Laws for the protection of things important to social improvement are absolutely essential, but the real, true force of growth lies in a strong determination on the part of our citizens to execute the laws. Unless this spirit is aroused in the minds of our people, Oregon horticultural interests will be worthless within five years. It is clear to my mind that the economic and social welfare of Oregon demands an awakened interest in the execution of the law for the protection of horticulture, and the horticulturist must be the man to create that spirit and insist that the law be executed. No half-hearted policy will suffice. Vigorous execution of the law is the only way to save the horticulture of Oregon.

That diversity in all things is the dominant feature of man's productions seems to be a truth beyond contradiction. His religion even is marked by its diversified forms, while the religious character of all of the lower civilization is stamped with uniformity. Variety, then, being the essence of civilization, it follows that the development of horticulture in its best form must be diversified.

The law, then, if it becomes an aid to society, must encourage and protect every form of horticulture suited to the soil and climatic conditions of our state. The prune, the pear, the peach,

the apple, the cherry, the grape, and the berry and the nut families all require proper consideration.

The continuous efforts of Hon. H. E. Dosch to introduce nut culture in Oregon is deserving of the highest commendation, and should receive far more attention and encouragement. Oregon is well adapted to the growth of many kinds of nuts, and their cultivation about the home, as well as for commercial purposes, would be a socializing power.

If diversity is the true evidence of the highest form of social life, it follows that diversified industry is a force in improving the mental and moral character of the people. The difference between the lower and higher orders of men, between the savage and civilized, is discerned in the diversity of clothing, housing, food, etc., of the higher man and the simplicity and uniformity of those used by the lower man. Diversified industry is the product of diversity of human wants, and a better mental and moral man is the product of diversified industry.

The regular, orderly and cleanly habits required in the dairy is one of the powers for the development of good character; the study of soils, grassy forage, and the breeds of animals, the study of bacterial machinery, butter and cheese culture add immensely to the intellectual power of the world. So it is with the orchard and garden; a knowledge and love of strawberries, raspberries, blackberries, gooseberries, currants, etc., will make any man stronger and better. A knowledge of soil physics, soil chemistry, botany and entomology, necessary to produce a successful commercial orchard, requires a higher degree of intellectual calibre than the average merchant possesses.

The mental powers and manly character developed in working the fields of horticulture are powerful elements in our social fabric. The close observation of nature required brings the man constantly in touch with truth and makes him a careful, conscientious and well-balanced student. The influence upon his entire being is such that his mental and moral powers are wonderfully strengthened.

I can conceive of no better way to add to the virtue, stability and grandeur of our state than by such an encouragement of horticulture as will secure its rapid growth.

In the subject of laws for the government of horticulture there is one most serious and perplexing problem, and that is transportation and marketing. Hundreds of carloads of the finest of fruits that were shipped from Oregon during the past summer gave the producer nothing for his labor, packers nothing for their industry and boxmakers no pay for their products. This has been a sad blow to the fruit industry, and these evils and

their proper remedies are perhaps the most serious and immediate problems for our fruit-growers to solve.

Whether or not any special law can be devised to overcome this difficulty, I am not able to say, but this I do know, that the true interest of the transportation companies is in perfect harmony with the fruit-growers' interest, and it is very important to the rairoads to see to it that our horticultural interests are developed, and to do that they must find some way of marketing our products so as to give the grower fair returns for his labor. The railroad companies of the northwest have as much interest in this as all the rest of us combined, and they should be our closest friends. They should be as good protectors of our life and vigor as the ant is of the green aphis.

Any protective laws concerning transportation should be upon the basis of common interest between the grower and the transportation companies. Transportation interests are dependent upon productions of a character that developes the best and highest civilization. Maintenance of horticulture in its best form is essential to the welfare of the transportation companies of the northwest, and there ought to be no conflict of interest between the transportation companies and the fruit-growers in arranging a plan to give the producers something for their fruit.

The situation must be radically improved over last year, however, when the railroad and commission people took their full toll of an extravagant nature and left nothing for the growers.

I desire to call your attention to a valuable provision of our national law that might be of great aid to horticulture if courted and encouraged by our growers. Out of the $15,000 of our annual appropriation to the Oregon experiment station, between $3,000 and $4,000 are used each year for the department of horticulture. The department of entomology, under Prof. A. B. Cordley, is doing much valuable work for the state. The board of regents of this institution does not contain a single horticulturist, and to this fact I attribute the small results to our horticultural interests for the expenditure.

The agricultural college should be the chief center of horticultural interest and the main point for the dissemination of practical problems of horticulture. This leads us into a modern field of thought, including problems of taxation, not alone for absolute protection of society, but for the training and cultivation of the youth under state and national patronage.

Is it wise for the state to select certain industrial lines of development and tax the people for the establishment and maintenance of training schools? I will not at this time enter into a general discussion of the subject, but will mention it as a question of immediate and vital importance to our industrial growth.

Our national government has recognized this principal by its appropriations for the maintenance of schools of agriculture and mechanical arts in every state. Many of the states have supplemented this with large additional annual appropriations, but the state of Oregon provides only $2,500 per annum. Even our reform school is not properly provided with appliances and instructors for industrial training.

I look forward to this special feature of law taxation for industrial education as very important to the growth of horticulture in Oregon. We are educating lawyers and doctors by the hundreds, but so far I have not been able to find a single horticulturist turned out from our educational institutions. Many of the European countries have grasped this problem of industrial culture, and, by proper schools, are leading the world in their lines. Norway, Denmark and Sweden have brought their countries to the front rank in dairying and other branches of agriculture by this method. Germany, by its great diversity of industrial training schools, is making most rapid strides in many forms of industry. The city of Berlin alone has 100 training schools, teaching as many as 70 vocations.

The cities, communities and the general government pay separate taxes for the maintenance of these institutions. Many of the great German industrial organizations and manufacturing companies provide instructors free, and give their employés time each day to attend places for instruction in their special line of work. By the development of art and skill in their industrial classes, Germany is leading the European world in all classes of manufactured products, and driving the Englishman's handiwork out of the English market. Nearly all the experiments of industrial training are proving successful.

Three great facts are becoming fixed in the world's progress:—

First.—Diversified industry is essential to social growth.

Second.—Protection by law in various forms is required for the development and preservation of the highest social condition.

Third.—Mental and moral culture by industrial education are essential elements in modern progress.

Applying these rules to the horticulture of Oregon, we have—

First.—The necessity for the development of every form of horticulture that is fitting to our soil and climatic conditions.

Second.—The creation and execution of all forms of laws required to protect this diversified industry.

Third.—Enlargement and improvement of schools for the training of our youth in various lines of horticulture.

The last can be well inaugurated by an appropriation that will improve our agricultural college and experiment station in its department of horticulture.

The New York college and station are doing a great work in establishing the science of horticulture throughout the rural districts of the state, by introducing in it the form of nature studies.

Some plan of this character should be developed in this state.

In fact, the Oregon agricultural college and experiment station should be the leading light and inspiration for the horticulture of Oregon.

To that end, I would suggest that the Oregon horticultural society urge upon the governor the advisability of appointing prominent horticulturists on the board of regents. The first step now in the creation, as well as the execution of law, is the formation of a strong industrial organization. Organizations of special industries provide the economic as well as political machinery by which ideas and wants are put into realities. It is therefore quite important that such societies as this should be active forces in formulating laws as well as demanding their execution. We have not yet learned the full value of organized effort for the promotion of horticulture. We must have our societies strengthened and more earnestly supported.

In closing, I desire to impress upon your minds the fact that the interests of horticulture are in your hands; its growth and prosperity are dependent upon your energies and activities. Whether or not it will be a great and growing industry, and a power for social good, depends upon you.

NECESSARY HORTICULTURAL LEGISLATION.

By ALEXANDER CRAW, quarantine officer state board of horticulture of California.

The possession of our new territories of Hawaii and the Philippine islands brings up a question of very serious moment to the horticultural interests of the United States, and more especially to California and the Pacific states, as at our ports are liable to be landed plants, trees and fruits that are infested with new and destructive insect pests or tree diseases. Heretofore we have had no direct communication with the Philippine islands, and with the exception of a few lots of *phalanopsis* (orchids) I have only inspected two plants that I know came from there. We have had nothing in the plant line whereby we can ascertain the species of insects peculiar to that country. I am not aware that anything has been published in relation to tree or fruit pests of the country. It is different in the case of the Hawaii islands, for we have a very good knowledge of the great list of destructive insects that attack their plantations and forests, and that are foreign to our orchards and gardens. Some of them are of recent introduction into the islands, but from the number and variety of plants found infested and destroyed I am sure our state would soon be overrun with them if a thorough quarantine cannot be maintained.

A CHANGE IN ARRANGEMENTS.

This is the point to which I desire to call particular attention. Until congress ratifies the annexation treaty the islands are considered a foreign territory, so all ships arriving from there are inspected by customs officers, and one or more customs officers are on guard day and night while the ships remain in port. The surveyor of the port, Hon. Joseph S. Spear, sr., and his first deputy, Chauncey M. St. John, like their predecessors, very kindly issued instructions not to allow any plants or fruit to be landed until inspected by the state board of horticulture. The customs officers, inspectors and dock officials are very obliging and gentlemanly in the enforcement of this order. The value of

this assistance to the state cannot be estimated. Under such an arrangement no plants can be smuggled away, to be afterwards landed. The annexation of the islands dispenses with the services of the customs officers to inspect the ship or the passengers' baggage upon arrival, and our horticultural regulations do not confer upon us the right to interfere with the personal effects or baggage of passengers, unless it is plants or fruit.

Now, it is very rarely that plants are packed with personal effects, but when passengers or members of the crew ascertain that valises are not to be inspected the inducement will be greater to try to get their plants ashore. Most people—not fruit-growers—consider it rather high-handed officiousness for us to even inspect their plants, and when the latter are found infested with insects and confiscated they consider that they are out and injured, but never take into consideration the fact that those harmless looking specks or bugs, if allowed to land, would probably cause a loss of thousands of dollars to other citizens who have invested their all in planting and caring for an orchard.

INSPECTION MUST BE MAINTAINED.

The only safeguard that I can suggest to prevent to a great extent any attempt at landing plants without inspection would be the enactment of a state law making it punishable by fine to bring into California any plants or trees without immediately notifying the quarantine officer of the state board of horticulture or the quarantine guardian of the district in which said plants or trees are received. As no penalty is attached to the violation of rule I of the regulations of this board it is practically a dead letter, although the Southern Pacific Railroad Company has rendered us very valuable service by keeping us advised of arrivals of trees and plants by rail from outside the state. The state board of horticulture, under the power conferred upon it by section 5 of the act of March 8, 1889, adopted rules and regulations to prevent the introduction of insect pests and tree and plant diseases, but it had no power to attach a penalty; so, in order to make such regulations effective, will have to submit a bill to the legislature providing penalties for non-compliance. Unless this can be done at the forthcoming session of the legislature, we are liable to have the work done in this line during the past few years completely nullified in the future.

THINGS TO BE FEARED.

Before presenting a bill for your consideration I desire to mention a few of the most serious insect pests and tree diseases that

have proved to be very injurious in other countries and states and which we have no reason to believe will prove less destructive if introduced into California

Probably the most serious would be the introduction of the gypsy moth from Massachusetts, Europe or Japan. The caterpillars of this moth devastate forest trees as well as fruit and ornamental trees and plants. The people of California would be up in arms if the state board of horticulture asked the legislature for an appropriation of over $100,000 a year to fight a single pest as they are now doing in Massachusetts, to try and stamp out this insect that was introduced into that state from Europe over twenty years ago.

A NEW PEACH DISEASE.

The "peach yellows" or the "peach rosette," it is claimed, would not spread in California, but the advice of an eastern expert on tree diseases is to keep it out. Now a new peach disease, called "small peaches," is reported from Michigan, where 4,000 acres are said to have been killed by it. A peach root aphis was introduced into Delaware, Virginia and Maryland, probably from Australia. Dr. E. F. Smith, of the United States department of agriculture, reports having seen a nursery of 100,000 peach trees killed outright by this pest in three weeks' time. One shipment of 19,000 peach trees was brought into California. I found them to be infested with the pest and the trees were destroyed. It also attacks plums and prunes.

In Louisiana a new species of "saw fly" has made its appearance which completely defoliates peach and prune trees. "In about two years they kill an orchard effectually." Prof. H. A. Morgan, of the experiment station at Baton Rouge, Louisiana., reports this pest as steadily becoming more numerous, until now it may be considered one of the worst enemies of the plum and peach trees of that state.

The introduction of the plum curculio would reduce the profits of prune, apricot and cherry-growers. The fruit fly in Australia and the larvæ of a beetle (*Doticus pestilens*), in the same country, burrow all through the pulp of apples, completely ruining them. The peach fly in the islands of Bermuda, and a similar pest in Cape Colony, makes peach-growing for profit impossible, as most seasons they have not enough peaches for local consumption.

ORANGE MAGGOT.

The disgusting Mexican orange maggot, if introduced into California orange groves, would soon stop the consumption of

our luscious Navel and other oranges. You can tell a wormy apple, but it is almost impossible to detect a maggoty orange until it is cut. A new worm infests apples in Japan and it is now reported in British Columbia, introduced from the former country.

BAD SCALES.

You can kill the so-called San Jose scale with sprays, but triple strength of the best insecticides will kill only 7 per cent. of the destructive white scale (*Diaspis amygdali*) found in the West Indies, Brazil, Australia, Japan and the Hawaiian islands. This pest is a very general feeder. We have destroyed the following trees and plants entering this state infested with it: Peach, plum, cherry, walnut, persimmon, tea, euonymus, sago palms and zanthoxylum. The introduction of the so-called Japanese beetle (*Adoritus umbrosus*) from Honolulu would be a bad importation. On the islands they defoliate grape vines, peaches, and in fact nearly all kinds of trees and plants are subject to their attack. The red wax scale was introduced in Honolulu a few years ago, and now we find it upon a great variety of plants brought from there, as well as on the evergreen "leis," or wreaths with which the Hawaiians decorate their departing friends. A great variety of scale insects foreign to California are found on the islands. One species, the mining scale (*Howardia, chionaspis, biclavis*), is one of the most serious. This is the scale that infested the 325,000 orange trees from Tahiti that withstood five fumigations with double and treble strength hydrocyanic acid gas and two immersions in strong insecticides. How could such a pest be even held in check in an orchard? The list of dangerous insects could be extended, but the foregoing will suffice to demonstrate that the fruit-growers of the state should urge the passage of a bill that would reduce to a minimum the possibility of such pests or diseases gaining a foothold or becoming established in California orchards.

THE TEXTURE OF THE SOIL.

By Prof. L. H. Bailey.

The other day I secured one sample of soil from a very hard clay knoll upon which beans had been planted, but in which they were almost unable to germinate, another sample from a contiguous soil in which beans were growing luxuriantly, and, as a third sample, I chipped a piece of rock off my house, which is built of stone of the neighborhood. All of these samples were taken to the chemist, Mr. Cavanaugh, for analysis. The area from which I took the hard and unproductive clay (sample 1). It is impossible to discover any bean plants upon it, although the seed was drilled into it at the same time as in the soil which furnished sample 2. This area is only twenty feet removed from the other and is of the same original formation, but it differs in being in a slight depression or "draw" and the soil is in a fairly fine degree of division. It is really a good bean soil. The rock (sample 3) was hard limestone, known to geologists as the tully formation. The chemist report as follows:—

	Moisture.	*Nitrogen.*	*Phosphoric acid.*	*Potash.*	*Lime.*	*Organic matter.*
I. Unproductive clay	13·25	·08	·20	1·1	·41	3·19
II. Good bean land	15·95	·11	·17	·75	·61	5·45
III. Lime rock	----------	----------	·08	2·12	2·55	----------

In other words, the chemist says that the poorer soil—the one upon which I cannot grow beans—is the richer in mineral plant food, and that the rock contains a most abundant supply of potash and about half as much phosphoric acid as the good bean soil.

All this, after all, is not surprising, when we come to think of it. Every good farmer knows that a hard and lumpy soil will not grow good crops, no matter how much plant food it may contain. A clay soil which has been producing good crops for any number of years may be so seriously injured by one injudicious plowing in a wet time as to ruin it for the growing of crops for two or three years. The injury lies in the modification of its

physical texture, not in the lessening of its fertility. A sandy soil may also be seriously impaired for the growing of any crop if the humus, or decaying organic matter, is allowed to burn out of it. It then becomes leachy, it quickly loses its moisture and it becomes excessively hot in bright, sunny weather. Similar remarks may be applied to all soils. That is, the texture or physical condition of the soil is nearly always more important than its mere richness in plant food.

A finely divided, mellow, friable soil is more productive than a hard and lumpy one of the same chemical composition, because it holds and retains more moisture; holds more air; presents greater surface to the roots; promotes nitrification; hastens the decomposition of the mineral elements; has less variable extremes of temperature and allows a better roothold to the plant. In all these ways, and others, the mellowness of the soil renders the plant food more available and affords a congenial and comfortable place in which the plant may grow.

The reader will now see the folly of applying commercial or concentrated fertilizers to lands of poor texture. He will see that if potash, for example, were applied to the hard lumps of sample 1, it could not be expected to aid in the growth of plants, because plants cannot grow on such soil. If the same quantity were applied to sample 2, however, the greater part of it would be presented to the roots of plants at once and its effects would no doubt be apparent in the season's crop. The reader will readily understand that it is useless to apply commercial fertilizers to lands which are not in proper physical condition for the very best growth of crops.

The poor or lumpy soil contained a greater percentage of potash and phosphoric acid, no doubt because of the lack of humus in the sample. As it contains less organic matter, it therefore has less nitrogen than the good soil (sample 2). Probably because of this less percentage of organic matter, this lumpy soil also contains less moisture than the other. As a matter of fact, however, these differences which the chemist found in the organic matter, nitrogen and moisture, are not sufficient to account for the very great differences in the productivity of the two soils. The chemical examination would have thrown more light upon the value of these soils if a determination had been made of the amount of potash and phosphoric acid which is soluble; but even then, the chemist could not have told, from analysis alone, how valuable this land might be for any particular crop. Analysis does not show how agreeable or comfortable the land may be to the plants. There is sufficient potash in the rock (sample 3), and even enough phosphoric acid, to grow a crop of beans; and yet, even if I add the nitrogen and water and make the

mineral plant food soluble, I cannot hope to grow a crop on the walls of my house. In brief, a chemical analysis of soil is only one of several means of determining the value of land, and in the general run of cases it is of very secondary value.

How can the texture of lands be improved? In general, by three means—by judicious plowing and tillage, by the incorporation of humus and by the use of underdrains. The value of simple tillage or fining of the land as a means of increasing its productivity was first clearly set forth in 1733 by Jethro Tull, in his "New Horse Hoeing Husbandry." The premises upon which Tull founded his system are erroneous. He supposed that plant roots actually take in or absorb the fine particles of the earth, and, therefore, the finer and more numerous these particles are, the more luxuriantly the plant will grow. His system of tillage, however, was correct, and his experiments and writings have had a most profound influence. If only one book of all the thousands which have been written on agriculture and rural affairs were to be preserved to future generations, I should want that honor conferred upon Tull's "Horse Hoeing Husbandry." It marked the beginning of the modern application of scientific methods to agriculture, and promulgated a system of treatment of the land, which, in its essential principles, is now accepted by every good farmer, and the appreciation of which must increase to the end of time. These discursive remarks will, I hope, emphasize the importance which simple tillage holds in agricultural practice.

Farmers do not appreciate the importance of humus as an ameliator of land. In farm lands it is usually supplied in the form of green crops, stubble or sward, and barn manures. When humus is absent, sandy soils become too loose and leachy and hot, and clay soils bake and become lumpy. The different physical characteristics of our samples 1 and 2 are largely due to the greater amount of humus in the good soil, and yet we have seen that the chemist pronounced the other soil richer in native plant food.

The writer has much of this hard unproductive land, like sample 1. What is to be done with it? To cover it with commercial fertilizer would be of little benefit. It must first be put in fit condition for the growing of crops. A crop of clover plowed under would quickly improve it, but the land is newly planted to orchard and he does not care to seed it down. The next recourse is stable manure. Of this enough can be had to cover the hardest spots. For the rest, catch or cover crops must be used. Following beans or potatoes, he can sow rye and plow it under very early in the spring (see Bulletin No. 102). Now and then he can use a fall crop of sowed corn or oats or something of the kind. After a time, he may be able to get the land in such a

condition of tilth as to secure an occasional stand of crimson clover. This practice, continued judiciously for a few years, ought to radically change the character of the land; but all this will be of little avail unless the plowing and cultivation—which are now so inadequate—can be done in a timely and intelligent way. All this will take time and patience. He wishes that there were some short-cut and lazy way of improving this land by making some application of fertilizer to it, but there is not. The most he can do is to slowly bring it into such condition that it will pay to put concentrated fertilizers on it. In short, the first step in the enrichment of unproductive land is to improve its physical condition by means of careful and thorough tillage, by the addition of humus, and perhaps by underdrainage. It must first be put in such condition that plants can grow in it. After that, the addition of chemical fertilizers may pay by giving additional or redundant growth.

SOME PRINCIPLES OF SOIL FERTILITY.

By G. W. Shaw.

In the history of every state there is a time when the soils begin to indicate exhaustion, and this time marks the beginning of the use of commercial fertilizers. This time has now come to Oregon. That this is true is attested by the increasing use of fertilizers by gardeners, orchardists, etc., as well as by the questions sent to the station and asked at institutes. That these inquiries should start with market gardeners who are cultivating small plats of land is very natural. It is also probably true that these people are securing relatively much larger returns from their lands than those who are cultivating a much larger acreage. That horticulturists at this early stage should be turning their attention to the matter of plant food is also natural, since orchards represent a much more permanent and costly investment than the annual crops of the farmer, and since the horticulturist cannot apply the valuable principle of crop rotation, but must continually remove from his soil the elements of plant food in a comparatively fixed ratio.

In the "good old times" the soils were quite abundantly supplied with all the plant food necessary for the crops, and the farmer reaped abundant harvests. The time was in the east when it required as little care and thought to raise farm and fruit crops as is now given to such matters by the average farmer of this coast. The farmers in the eastern states several years ago came to realize the immense robbery they had perpetrated upon their lands, and more recently the horticulturists of the same states have been brought face to face with this fact. An article recently appeared in the Rural Northwest from the pen of Prof. W. F. Massey, from which I quote:

"There is no doubt that the many failures in fruit production in the east are largely due to the exhaustion of important elements of plant food in the soil. All farmers realize the importance of keeping up the fertility of the soil for the production of their annual crops of grain and vegetables, but somehow the idea has been prevalent that a tree can take care of itself. Men look at the great trees of the forest and see how they grow and

how the soil increases in fertility under their influence, and think that the same should be the result in the growing of fruit trees, while they are carrying off continually not only the fruit that the orchard produces, but in many cases expect the land also to produce food for their stock. And then when the orchard fails to give the expected fruit, and its decrepit condition makes the trees alike the prey to insects and fungus diseases, they declare that the climate has changed and we can no longer produce crops for that reason. It has really been because they and their fathers have robbed the soil until the needed food for the production of healthy trees and perfect fruit is no longer available."

It would then seem wise for us to study what has been ascertained concerning the subject of soils and crop production, but at the outset let me say that no inflexible rules can be laid down in such matters for many cases will require special consideration. Failure of a soil to produce good crops is not always due to lack of fertility, but may often be traced to faulty cultivation, poor drainage or other equally potent causes. It would indeed be unwise for anyone to think of fertilizing till he has put his soil in the proper condition to use the fertilizer. Then and not till then should much attention be directed toward commercial plant food.

Of the seventy or more elementary substances which the subject of chemistry has revealed there are but twelve or fourteen of value to crops, but each of these is absolutely essential and if any one is lacking, it matters not how abundant the supply of others, plants cannot grow. Only 5 per cent. of vegetable substance is taken from the soil, but small as this may seem, it is of the utmost importance that the proper amount be present and that the different constituents be in the proper form, for without them the 95 per cent. of matter taken from the atmosphere, consisting principally of carbon and water, cannot be assimilated by the plant. The kind and number of elements that constitute the ash have been determined by carefully conducted experiments the details of which I shall not attempt to explain. Suffice it to say that of the twelve or fourteen elements essential to plants there are but four that demand serious attention from the farmer, for all the others are so abundantly supplied by nature, under ordinary circumstances, that plants can secure a great sufficiency of them. Those which are often deficient in soils, or which may become so from continued cropping are lime, potash, phosphoric acid and nitrogen. Perfect plant growth is only reached when all these are present in the proper form and the requisite quantity. Every farmer and horticulturist should become familiar with the function of each of these elments so vital to plant growth. Lime is found in most soils in a reasonable quantity,

usually in the form of a carbonate or phosphate, but sometimes, as we shall see later, as a silicate in which form it is of less agricultural value than in either of the others. To exert its beneficial effect in neutralizing the acidity of solids produced by the natural decomposition of organic matter in the lime must be in the form of carbonate, but either of the others might supply a sufficient amount of plant food as which the lime is concerned in the conversion of starch into cellulose or woody fiber.

Potash is the compound resulting from the chemical union of a soft, waxy, bluish metal potassium, with the element oxygen, for which the metal has such an affinity that it will even decompose water to obtain it. In nature it is found combined with acids, as sulphuric, carbonic or silicic, and several compounds containing two or more metals. Something more than its mere presence in soils is necessary for healthy plant growth, for there must be a tolerably abundant supply. Its presence in considerable quantities in the ash of plants is evidence of a considerable natural supply, which is, for the most part, feldspar, mica and a few minerals of lesser importance. One of the earliest subjects to be investigated was the relation of this element to vegetable life. Experiments show that when potash is deficient in soils, plants suffer greatly in their woody portion and in the fleshy part of their fruit. Plants use the potash in the early part of their growth and the element suffers a retrograde movement in the plant about the time of maturity. Its function in plant economy has been the subject of much study on the part of agriculturists, the results of whose labors may be summarized as follows:—

First.—The element is essential for the assimilation of carbon and its elaboration into starch, giving strength to the cell tissue. Thus the plant suffers greatly in the woody portion in the absence of potash in requisite quantities.

Second.—It is associated with starch in its translocation from cell to cell and its transformation into sugar. Hence, the size and quality of fruit is materially affected by a deficiency of potash.

Third.—It is required for a proper development of the fruit acids or their acid salts so important in imparting an agreeable flavor to fruits.

In a chemically pure state, phosphorus is a soft, yellow, waxy, solid and extremely inflammable on account of its great affinity for oxygen. The element never occurs in a free state, but is combined with lime, magnesia or iron. It is from these phosphates that the agricultural phosphoric acid is obtained. The phosphates found in soils are partly in a form readily utilized by plants and partly in an insoluble form which has to be sub-

jected to the influence of water, carbonic acid and air before it is assimilable by plants. As with potash plants, they need their supply of phosphorus in the early part of their growth. Wheat demands 80 per cent. of the total in the first half of the growing period. Clover assimilates practically all of its phosphorus before bloom. The function of the element appears to be that of stimulating the assimilation of other mineral substances and promoting root development. It is intimately related to the nitrogenous matter in plants for a high nitrogen content is usually accompanied by a high phosphorus content. While both nitrogen and phosphorus accumulate in the seeds or pits and neither is subject to the retrograde of potash, yet experiments show that the action of the two is entirely independent of each other. So important is this element that no perfect plant has ever been produced without phosphorus in the form of phosphates.

Nitrogen, one of the most permanent and widely distributed elements, constituting about four fifths of the earth's atmosphere, is an essential component of all plants and animals. Notwithstanding the great abundance of this element in the air, yet in this free state it is of no direct benefit to plants for it must first be combined with oxygen or hydrogen as nitric acid or ammonia before it can be used by the plant. It is present in the soil in the form of nitrates, ammonia salts or the more complex organic compounds known as humus. Its function is to strengthen plants in their early growth. It favors leaf development and imparts a deep, healthy, green color to the foliage. In excessive quantities it will produce a rank growth of foliage at the expense of fruit development and flavor.

Thus having covered the function of these critical elements in plant economy, I propose to discuss the second part of my paper, first from the standpoint of material removed by crops, and second from the composition of Oregon soils.

The subjoined table will give some insight into the plant food removed from the soil by a number of the leading fruit crops, taking as a basis an ordinary yield of the crop cited:—

	Potash.	*Phosphoric acid.*	*Nitrogen.*
Grapes, per acre	*50 pounds.*	*15 pounds.*	*17 pounds.*
Apples	16	00.6	17
Pears	36	10	12
Prunes	51	12	12·6

Thus it is seen that prunes make a very heavy draught on the side of nitrogen and potash; in the case of nitrogen greatly

exceeding that of any other of the prominent fruits. As regards the total mineral matter removed, grapes head the list, so far as the fruits of interest to us are concerned; that the orange surpasses it by about 2½ pounds per thousand of fresh fruit. In the case of grapes it is well also to note that nearly five sixths of the total mineral matter is potash, which is also true of prunes.

There is quite a striking difference between apples and pears, so far as potash is concerned, the former removing less than half as much as the latter; the phosphoric acid draught is much heavier in the pear; the nitrogen content is the same, but much less than in the prune, which has seven times as much, and must then be considered more nourishing than either of the above, and certainly more exhaustive to the soil.

To more strikingly illustrate the difference in the draught of crops on soils let me direct attention to our most common crop, wheat, which we see that an ordinary crop of 25 bushels to the acre would remove in the kernals 8.5 pounds of potash, 14 pounds phosphoric acid and 28 pounds of nitrogen; a draught of 22.5 pounds of mineral matter against 63 for prunes, nearly two thirds of which is phosphoric acid. Thus it is seen that there is a material difference as to the plant food removed by different crops, and I venture to predict that those who are growing fruit will be forced to realize that there is a vast difference between the growing of wheat on land rich in the ingredients demanded by that cereal and the production of prunes year after year which draw heavily on the side of potash. I venture, further, to predict that this will not be brought to their attention through a decrease in the size of the pits, but rather, first, in a lack of properly developed fruit, and in a loss of flavor. This prediction I make as a result of the laws above stated, which may be regarded as holding good in all countries and on all soils, and further from the results of investigations on the soils which will appear later.

I am quite certain that my prediction which was first made some years ago, has already been fulfilled in part by the recognized conditions of some of the older prune and apple orchards and that those who have tried the remedy suggested have been well satisfied with the results.

There are in Oregon 26,000 acres devoted to prune-growing. Have any of you ever stopped to consider the plant food that will be annually shipped out of the state with the fruit from these orchards?

Taking as our basis the average yield for an acre, there will be an annual drain of 163,200 pounds of potash 222,400 pounds of phosphoric acid, 403,200 pounds of nitrogen and 588,800

pounds of plant food, representing a commercial value of $96,960 for the prune orchards alone.

From this data I think it is seen that in the case of wheat the wear is a "one-sided" one on phosphoric acid, and in the case of fruit is equally "one-sided" on potash. This one-sided wear is, of course, inseparable from the horticultural interests of the state, and, for this very reason, demands the most careful attention, for I think it is clear that to apply complete fertilizers in such cases would indeed be carrying coals to Newcastle, by adding ingredients to the soil that are already abundantly present in an available form.

But let us turn attention to the condition of our soil for still further information in this important field. As a basis for discussion, the following may be taken as the minimum percentages for a thrifty growth of crops, although it must be admitted that the amounts necessary for successfully growing a crop will differ somewhat with the nature of the crop and very materially with the physical condition of the soil:—

"*Lime.*—0.10 per cent. in the highest sandy soil; 0.25 per cent. in clay loams; 0.30 per cent. in heavy clay soils, and it may rise with advantage to 1 or 2 per cent.

"*Phosphoric Acid.*—In sandy loams, 0.20 per cent. when accompanied by a good supply of lime. The maximum found in the best Mississippi table lands was 0.25 per cent.; in the best bottom land of the same region, 0.30. His investigations in connection with the Northern Pacific survey also showed that this ingredient was more abundant in the soils of Oregon and Washington than in the soils of California. In the basaltic soils it may even run as high as .30 or more.

"*Potash.*—The potash percentage of heavy clay upland soil and clay loams ranges from about 0.8 to 0.5 per cent.; lighter loams from 0.45 to 0.30; sandy loams below 0.30 and sandy loams o great depth may fall below 0.10 consistent with good productiveness and durability. Virgin soils with a less percentage than .09 he finds deficient."

The same author, Professor Hilgard, who is, perhaps, the best authority in this country on the subject of soil, says in another article that "no virgin soil having .50 per cent. or over of potash will wear out first on that side of the store of plant food; and much less will suffice in the presence of much lime and humus."

"Humus is of great interest to us, since it is the storehouse of the nitrogen supply, and its determination serves as a measure of that element. In oak uplands of the cotton states the range is usually between .70 and .80 per cent.; in the poorer sandy soils from .40 to .50 per cent.; in black calcareous 1.2 to 2.80 per cent.

In Western Oregon it is not uncommon to find 3 and even 6 per cent."

It is not our purpose to discuss, at this time, individual soils except so far as they serve the purpose of illustration, but rather to discuss general soil propositions and to point out some of the differences existing in the typical soil areas. As a basis for discussion, below will be found a table showing the average composition of the Willamette valley soils, made up from 42 analyses, and in parallel columns will be found the average composition of California soils and of the humid region farther east. When studied in the light of the preceding principles of interpretation much information may be gleaned:—

Analysis of fine earth.	*Willamette valley.*	*Average for states — humidity.*	*Average for California — aridity.*
Insoluble matter	65·18	84·03	67·88
Soluble silica	5·02	4·21	8·96
Potash (K_2O)	·23	·22	·94
Soda (Na_2O)	·18	·09	·28
Lime (CaO)	·83	·11	1·08
Magnesia (MgO)	·76	·23	1·49
Manganese (Mn_3O_4)	·08	·13	·06
Iron (Fe_2O_3) } Alumina (Al_2O_3) }	16·45	7·43	15·02
Sulphuric acid (SO_3)	·03	·05	·05
Phosphoric acid (P_2O_5)	·21	·11	·08
Water and organic matter	10·77	3·46	4·40
Total	99·77	100·19	100·05
Humus	1·63	1·50	·75

Turning attention at first to the lime content, we find it to be .83 per cent., a somewhat higher figure than that given as probable from data at hand four years ago. Basing our judgment on the principles previously laid down, the valley soils as a rule could not be considered deficent in this ingredient, the figures in many textbooks notwithstanding. It is popularly supposed that the valley soils are deficient in this ingredient, hence I feel that on account of this widespread idea and its great importance to the horticultural interests, the matter demands a careful consideration. I am at a loss to understand the general acceptance of this idea, unless it be, first, that no considerable deposits of lime occur within this area; second, that the older textbooks have placed the limits for a calcareous soil altogether too high (from 4 to 20 per cent), as shown in more recent experiments; third, that poor results are often obtained with clover, which is known to be a lime-using plant. However it may have sprung up, it is a fallacy, at least so far as the bottom lands are concerned. Waiving the first possible cause of this notion as indicating nothing

on the negative side of the lime question, as there are other compounds which may give rise to lime in soils, we come to the textbook statement concerning a calcareous soil. It is admitted that the soils are not markedly calcareous, yet "very much smaller percentages suffice to do all that lime can do; in very sandy soils less than two tenths of one per cent. impart the calcareous character to vegetation; in very heavy clay soil from one half to three fourths of one per cent. is necessary for the same purpose. But any further addition of lime to such soils changes the character of the vegetation no further unless pushed to the extent of modifying materially its physical condition." It is admitted as true that poor results with clover are often obtained, but that this is due rather to the present physical condition of the soil than to any inherent deficiency has been amply proven by results obtained at the station and also by those farmers who have solved the problem of a proper physical condition for the crop. At the present time lack of drainage lies at the root of the difficulty with this and many other crops in the Willamette valley. The presence of lime is well shown in the trouble so often experienced with the drain tile made in the valley. The tile are often found to blister and crack which under the condition may be easily explained from slacking of the quicklime formed in the burning of the calcareous clay. The soils of the Willamette valley seem to be moderately supplied with lime but carry a much less amount than either the soils of Southern or Eastern Oregon, the former on account of geological reasons and the latter on account of climatic conditions. That these soils should be fairly well supplied with lime would be expected from *a priori* reasons on account of the basaltic origin a large part of them. The lime in the valley soils is not altogether in the form of a carbonate; indeed, it is rare that sufficient carbonate is present to cause evident effervescence with acid, but even a casual examination shows a very common occurrence of easily decomposable zeolites, from which, by weathering, the lime may be constantly supplied. The decomposition of such rocks as those mentioned above would naturally produce soils rich in lime and poor in potash. Referring now to the minimum per cent. of potash for a strong clay loam we find it ought to carry at least .30 per cent. to be consistent with good productiveness and durability, but in referring to the average content of the valley soils we find but .23 per cent., an amount much smaller than could be desired. But this is as consonant with our premise that such soils are likely to be low in potash as is the high lime content. It is altogether probable, however, that the potash of these soils is of a high general availability on account of the widespread disintegration of basaltic rock and zeolites. It is a well known action of lime to render

available potash compounds otherwise inert. Just here, methinks, is, in a measure at least, the explanation of the wonderful fertility of the northwest soils, but long continued draughts on the side of potash, as will be made by prune culture, is likely to rapidly deplete the soils of this ingredient. Knowing this about the potash content of our soils is it not reasonable to assume that this fact has something to do with the lack of thrift of old apple orchards as well as a lack of flavor in the fruit? For it is a fact well known to science that when potash is deficient in soils plants suffer greatly in their woody portions, which is likely to render them susceptible to attacks of fungous diseases, and in the fleshy part of the fruit, hindering the formation of starch and its conversion into sugar. Taken altogether, then, this question of the relation of potash supply to the health and thrift of our prune orchards, which remove large amounts of this ingredient, is a most important and interesting one, and will demand careful study on the part of the station. In the light of the present indications it is altogether likely that when the valley soils "give out" it will be first on the side of potash, and that in not a few instances could it be used to advantage now.

Analysis shows the phosphoric acid content to be about .21 per cent., which is all that could be desired, yes, even abundant. It is not at all likely that this will be demanded for many years to come, and this will be particularly true of the hill lands. This heavy per cent. of phosphoric acid in our soils, together with the probable high general availability of what potash does exist, will go a long ways toward explaining the long continued productiveness of the northwest soils, when sowed to grain. But when the conditions are so changed as to bring the draught very heavily on the side of potash, as will be done in prune culture, if we may judge from the chemical nature of the soils, it is not at all probable that anything like these lasting qualities will be shown.

The humus content of the soils—a fair measure of nitrogen—is excellent, 1.63 per cent, and largely exceeds that of California, .75 per cent., in whose soils the potash content is high. With proper care in the treatment of our soils it will be a long time before high-priced nitrogenous manures will have to be resorted to. It is not at all uncommon to find soils showing 2.5 per cent., and in rare cases even more.

Limiting the discussion to the bottom loams, they are rich in phosphoric acid and humus; well supplied with lime, not in the most desirable form, and weak in potash. Comparing the hill lands with the bottom lands, while the former may equal the latter in potash and humus, and surpass them in phosphoric

acid, yet, the potash of the hills are probably not as available, nor do they contain as much lime.

From analyses that have been made it appears that the soils of Southern Oregon, in general, carry considerably more lime than do the soils of the Willamette valley—at least twice as much—the average so far stands 2.22 per cent. for the former, against .83 per cent. for the latter. Such a condition we would expect to find from geological reasons, this section having been the area of fringing and barrier reef lime deposits in the early geological history of Oregon. The lime is most frequently present as a carbonate.

It is safe to say that the soils are stronger than the Willamette valley soils, not only in lime, but also in potash, but weaker in phosphoric acid. It is not likely that these soils will first wear out on the side of potash, but rather on the side of phosphoric acid. In this respect they approach the California soils, as will be seen upon examination of the chart, although richer in phosphoric acid. The humus content of the soils of Southern Oregon thus far examined has been considerably higher than in the Willamette valley. We are not prepared to offer an explanation of this fact at present, although it may be due to the long continued wheat crops grown on the latter soils, and the open culture thus necessitated.

Taken all in all, the most lasting soils for the prune in Western Oregon will doubtless be found in the dark loams of the Umpqua valley. These are fairly represented by the following analyses:

Comparing the soils of the arid with the humid areas along the lines of so-called critical elements, it will be noted that the two sections differ markedly in lime content—the Eastern Oregon soils carrying much more lime than those of the humid or western area. There is one feature that differs materially so far as observed, viz., that there appears to be no great difference between the lime content of the uplands and the lowlands of the arid area. This conforms with conditions pointed out by Prof. Hilgard, of California, that all arid soils are naturally calcareous.* The converse of this, however, is by no means true, for there may be local causes which will very materially alter the conditions. We have an illustration of this in the southern area of the humid region, where the lime supply surpasses that of the arid area.

The potash supply of the Eastern Oregon soils is also superior to that of the humid area, standing .43 per cent. against .23 per cent. In view of this abundant supply it is not at all likely that these soils will wear out on the side of potash. The greater abundance of potash in these soils is augmented much by being in a very soluble form, thus rendering it even more available

than that in the soils of the Willamette valley. The phosphoric acid supply of the humid area, however, is superior, being .21 per cent. against .14 per cent. for the Eastern Oregon soils. This is doubtless the weakest point in the soils of the arid area of the northwest.

The humus percentage is excellent, although, as might be expected from climatic reasons, not as high as in the Willamette valley, but recent experiments indicate that the humus of the arid regions carries much more nitrogen than do those of humid areas in the ratio of 3 to 1. If in future experiments this proves to be true in our state, as without doubt it will, it means that while the humus per cent. is lower the actual nitrogen content is higher in the Eastern Oregon soils than those of the western area. Summarizing the lime, potash and phosphoric acid of the three great areas, we find it as follows:—

	Willamette valley.	*Southern Oregon.*	*Eastern Oregon.*
Lime (CaO)	·83	2·22	1·22
Potash (K_2O)	·23	·34	·43
Phosphoric acid (P_2O_5)	·21	·13	·14

The alkali soils so common in Eastern Oregon are the very richest in the state, a number of the compounds composing the alkali being recognized as of direct value as fertilizers, as sulphate of potash, phosphate of soda, nitrate of soda, chloride of soda and carbonate of ammonia, which occur together with the sulphate of soda, and carbonate of soda mentioned above. Thus it will be seen that from the very nature of the case these soils are bound to be very lasting, and in many instances will well repay for the trouble required to recover them.

Thus, I think it will be evident that soils differ much in their composition, as well as crops, and whatever system of fertilization may be practiced, whether it be the rotation of crops or the application of commercial plant food, attention should be given to this fact. Of course, in the case of the horticulturist recourse can only be had to the latter method and green manuring. Right here let me say that I believe orchardists would have far less fungus diseases to fight were the trees in all cases properly nourished. This lack of nourishment may be due in some cases to insufficient mineral food in the soil and at other times to such poor drainage conditions as to prevent the proper action of that already in the soil. How, then, may we maintain the fertility of the soil that we may produce fruit of good quality and that our trees may remain vigorous and healthy, is an extremely vital

question. What are the materials available as fertilizers here in the northwest? Someone says stable manure. Yes, that is good. Much better on the orchard than leaching under the eaves of the barn for years. Unfortunately, in horticultural communities this valuable material cannot always be had in requisite quantity. On the heavier soils of the Willamette valley or Southern Oregon the indirect action of such manure, together with which may be classed straw and similar material, might be of quite as much value as its direct action, *first*, for the vegetable matter thus added to the soil will materially improve the absorbing and retaining power, and *second*, on account of the increased bacterial activity induced in the soil causing nitrification.

While the actual fertilizing material in a ton of average stable manure is small—not being much above 28 pounds—if lime be not considered, yet its great value is not to be questioned. The nitrogen from the digested part of the food as well as a large part of the potash is found in the liquid portion, while the nitrogen of the undigested portion and a large part of the phosphoric acid is contained in the solid residue. In the use of manures it should be remembered that they are essential nitrogenous fertilizers and to exert their maximum good they should be supplemented with more concentrated material and, secondly, that orchards should not be given an overdose else there will be a crop of sappy wood and foliage instead of fruit. This, indeed, is true of any nitrogenous manure, hence in orchards they must be handled with much judgment. Green manuring must also be classed under this head and it is probably the most available method of maintaining the nitrogen supply of the soils in the northwest. This consists in plowing under a green crop at the time of blossoming or earlier and leaving it to decompose in the soil where the fertilizing ingredients in the crop turned under are set free in the soil. There is much choice in plants to be thus grown, for certain plants, as clover, vetches, lupines and the like, have power to gather that costly element—nitrogen—from the air whence it may be had without money and without price. Other crops that might be used with profit are buckwheat, mustard and rape. Much good would come to many of our heavier soils in the way of improved textures and a greater retentiveness to moisture by a more liberal use of such green crops.

Among the nitrogenous fertilizers available in the northwest may be mentioned Chili saltpetre, containing 16 per cent. nitrogen and tankage of very uncertain composition, the latter often containing material which decomposes slowly, as hoof and horn waste and hair, which are hardly worth purchasing. The nitrate of soda or Chili saltpetre is a very powerful and quick acting fertilizer and should be applied to growing plants only. Its price

is prohibitive except for forcing market-garden crops. It cannot be used with profit on any low-priced crop. The secret of success in horticulture, as in agriculture, will soon be the knowing how to manufacture manure cheaply, and as a nitrogenous fertilizer the growing of clover will solve the problem. Its seed is cheap; it is easily planted; it requires no mixing as other fertilizers do; it requires no spreading; it is in the right place; it is most beneficial to our soils. All of which combine to place it in the front rank of fertilizers.

As to phosphatic fertilizers little need be said, as they are not likely to be a serious question in the northwest. For the orchard there is nothing better than fine ground bone — if the bone is very finely ground you need not pay for the extra treatment with acid. It also has some value as a nitrogenous fertilizer. One of the most available forms of phosphatic material in the northwest is the fish waste from salmon canneries, nearly all of which is now exported to the Sandwich islands as a fertilizer — those progressive people using large quantities on their plantations.

There is practically but one source of potash, and that is the German potash salts, muriate or sulphate. These are both concentrated foods, carrying approximately 50 per cent. of actual potash. I would not advise the use of kainit for it is a low grade mixed material and consequently relatively more expensive on account of increased freight, due to the greater weight of the material. We do not need to supply our soils with other materials in kainit. On heavy soil these potash salts should be applied in the fall for the best results. On orchards from 200 to 400 pounds per acre should be sufficient for two or three years.

Wood ashes are also a limited source of potash. When unleached they carry from 5 to 10 per cent. of potash in the very available form of a carbonate. On account of their lime contents they are particularly valuable on light soils, but unless used with an equal quantity of gypsum are likely to "puddle" the more compact ones. Ashes can often be obtained at a very nominal figure and no one should fail to take advantage of any opportunity to thus enrich his soil.

Now, in closing, let me say again that it is not wise to rush blindly to commercial plant food if your orchard does not have a thrifty appearance and is not producing its measure of fruit. Look first to nature, then to yourself, asking whether you have done all that nature demands in the way of proper drainage and tillage. Being satisfied on these points, then seek your remedy in external material by rational methods of fertilization.

MANURING ORCHARDS.

By Prof. Edward B. Voorhees, director of the New Jersey state agricultural experiment station, New Brunswick, New Jersey.

My main purpose in this discussion of the question of manures for orchards is to show the necessity of studies and investigations concerning the food requirements of the various fruits, rather than to point out methods of practice that shall be economical and systematic. We have suggestions from numerous sources in regard to the particular needs of particular kinds of fruit for plant food, but we have in the reports of our experiment stations and agricultural societies very few results bearing upon this subject which have been derived from actual experiment. It is quite natural, perhaps, that this should be the case, because fruit-growing as a business, or on a commercial scale, is comparatively new, and because the character of the investigations necessary to be carried out in order to obtain reliable data must be continued. The development of fruit-growing as a specific crop has, too, been gradual, and has found its first considerable increase in sections of the country within easy reach of good markets, and upon soils particularly adapted for the purpose, which, perhaps, furnishes another reason for a lack of scientific investigation along this line.

FRUIT CROPS AND GRAIN CROPS DIFFER IN RESPECT TO THEIR NEEDS FOR PLANT FOOD.

It is obvious, too, that such specific results as have been obtained concerning the needs of general farm crops, as grain and grass, for specific plant food elements cannot be applied with any degree of accuracy to fruit crops, particularly the larger fruits, as pears, apples, peaches, grapes and plums, because these differ from the cereals, grasses and vegetables, *first*, in their habits of growth; *second*, in the character of the produce; and *third*, in their relation to soil exhaustion.

In the first place farm crops, as a rule, require but one year for the entire processes of vegetation and maturation. For fruit crops, with but few exceptions, the purely vegetative processes continue for at least three years, and with many kinds much

longer, while after the fruit-bearing period begins the vegetative processes do not cease, but are coincident with the growth and ripening of the fruit. In the second place, the product of the harvest, namely, the fruit, differs very materially in its character from that of ordinary farm crops which mature their fruit and die in one season, because a whole season is required for its growth and development; that is, it is necessary that there shall be a constant transfer of the nutritive juices from the tree to the fruit throughout the entire growing season, while the growth for each succeeding year of both tree and fruit is dependent upon the nutrition acquired and stored up in buds and branches, as well as upon that which may be derived directly from the soil. In the third place the relation of fruit-growing to soil exhaustion is very different from that in general crop farming, because in orchards there is an annual demand for specific kinds and proportions of soil constituents; it is really a continuous cropping of the same kind; there is no opportunity, as in the case of ordinary farm crops, to correct the tendency to exhaustion by a frequent change of crops, or the frequent growth of those which require different kinds and amounts of plant food constituents.

NITROGEN, PHOSPHORIC ACID AND POTASH ARE THE ELEMENTS NEEDED IN MANURE FOR ORCHARDS.

In studying methods of manuring orchards, however, it must be admitted that the general principles of manuring, which apply to fruits, apply quite as well to farm crops; that is, the essential constituents of manures must be the same. A fruit tree will not make normal growth in a soil destitute of nitrogen. That nitrogen encourages leaf growth is a recognized fact, and, since trees grow by means of both leaf and root, its presence is required in the soil in order to promote the growth and extend the life of the tree. It is very evident, too, that potash is an essential constituent in the growth of fruits, not only because it constitutes a large proportion of the ash of the wood of the apple, pear, cherry and plum, and more than 50 per cent. of the ash of fruit, but because it forms the base of the well known fruit acids; and in order to nourish a tree properly, as well as to insure proper ripening, phosphoric acid is also very essential, though it is apparent from such investigations as have been made that this constituent is relatively of less importance than for the cereals. It is also a matter of common observation that, in the production of stone fruits particularly, lime is an important constituent. Its function seems to be to strengthen the stems and woody portion of the tree, to shorten the period of growth and to hasten the time of ripening. Fruit trees growing on soils rich in

lime show a stocky, steady, vigorous growth and the fruit ripens well, while those on soils which contain but little lime, particularly the clays, appear to have an extended period of growth, the result of which is that the wood does not mature and the fruit does not ripen properly.

THE NEED OF MANURES FOR ORCHARDS.

It is argued by many, and sometimes by those who should know better, that fruit-growing is quite similar to growing trees; that the question of soil exhaustion is not a matter of very great importance, provided the soil is well cultivated, and that all soils contain sufficient quantities of the food elements to insure the relatively small available supply required from year to year. It is admitted that on soils of good mechanical condition, well drained and cultivated, which are naturally adapted for fruit as well as other crops, because well supplied with the essential constituents, nitrogen, phosphoric acid, potash and lime, the exhaustion arising from the continuous removal of crops will not become apparent for a long time, but it should be emphasized that it is only upon soils which possess these characteristics that the growth of fruit, even poor fruit, can be continued for any considerable period without the application of manures. While we have abundant evidence of the need of manures for orchards, derived from our knowledge of the fact that even virgin soils possess, as a rule, a low rather than a high natural strength, and are, therefore, incapable of furnishing for a long time a sufficient amount of one or more constituents, I desire to present further evidence, derived, *first*, from experiments conducted to determine the relative needs of plant food by certain fruit crops, and *second*, from such results of actual practice as I have been able to collate. The only completed experiment in this line is reported by the New Jersey experiment station on peaches.* This experiment was begun in 1884, and the results fully reported in 1894, though I shall only use the results secured up to 1894.

The object of this field experiment was to study the comparative effect on an annual supply of what was deemed a sufficient quantity of the best forms of the three plant food elements, nitrogen, phosphoric acid and potash, when used singly and in various combinations, and of large applications of barnyard manure. The experiment included 13 plots, each one tenth of an acre in area and containing 13 trees. Each of the fertilized plots received an annual application of 150 pounds of nitrate of soda, 350 pounds of bone-back superphosphate, or 150 pounds of

*Annual report, New Jersey experiment station, 1884-1894.

muriate of potash per acre, thus furnishing an equivalent of twenty-four pounds of actual nitrogen, or fifty-six pounds of "available" phosphoric acid, or seventy-five pounds of actual potash on the three plots which received single elements, and combinations of these amounts of two of the elements on three other plots and a combination of all, or a complete fertilizer, on one plot. In addition, two plots were not manured; one received land plaster at the rate of one hundred pounds per acre; one barnyard manure, at the rate of twenty tons per acre, and one barnyard manure at the rate of ten tons, and lime at the rate of fifty bushels per acre. Accurate records were kept each year of the health and vigor of the trees, and of the yield of the various plots. The soil—a clay loam with clay subsoil—was of medium natural fertility, responding readily to manures; its mechanical condition good, and fairly representative of the soil in the peach-growing sections in New Jersey.

At this point I will give detailed results and comparisons only in case of the plots without manure, with a complete manure, and with barnyard manure. The average age of an orchard in our state is about eight years, during which period three full crops are usually secured. I therefore give the average yield in baskets for the average period of the life of the orchard; for the whole period of the experiment, and for the crop years.

I—THE YIELD WITHOUT MANURE.

	Baskets per acre.
1884–1891, inclusive, eight years, average per year	65·7
1884–1893, inclusive, ten years, average per year	60·3
1887–1891, inclusive (five crop years), average per year	105·0
1887–1893, inclusive (seven crop years), average per year	86·2

II—THE YIELD WITH COMPLETE CHEMICAL MANURE.

	Baskets per acre.
1884–1891, inclusive, eight years, average per year	164·2
1884–1893, inclusive, ten years, average per year	183·4
1887–1891, inclusive (five crop years), average per year	262·8
1887–1893, inclusive (seven crop years), average per year	262·0

III—THE YIELD WITH BARNYARD MANURE.

	Baskets per acre.
1884–1891, inclusive, eight years, average per year	169·5
1884–1893, inclusive, ten years, average per year	194·7
1887–1891, inclusive (five crop years), average per year	271·3
1887–1893, inclusive (seven crop years), average per year	276·8

IV—THE RELATIVE YIELD IN AN UNFAVORABLE SEASON.

	Baskets per acre.
1889, unmanured	10·9
1889, fertilized	152·5
1889, manured	162·5

The first point of importance and value observed is in reference to the number of crops that were secured. On the unmanured land, the crops secured after eight years were so small as to materially reduce the average for the whole period, while for the manured land the average for the whole period was not only not reduced, but very materially increased; that is, the crops secured on these, after the trees on the unmanured land had practically ceased to bear, were greater proportionately than those secured previous to that time. This was true both for the fertilized and manured land. In the next place, it is shown that the yield was very materially increased by the use of manures, either in the form of artificial or natural supplies, and the differences in yield derived from these two forms are very slight, indicating that very much smaller amounts of actual plant food in quick acting forms were quite as useful as larger amounts of the less available forms in which the food exists in natural manure products. For the ten years, the fertilized plot received two hundred and fifty pounds of nitrogen, five hundred and sixty pounds of phosphoric acid and seven hundred and fifty pounds of potash, while the yard manure plot received—assuming the average composition of yard manure—two thousand pounds of nitrogen, two thousand pounds of phosphoric acid and one thousand six hundred pounds of potash; yet with eight times as much nitrogen, nearly four times as much phosphoric acid and more than twice as much potash, the yield was but one hundred and thirteen baskets greater, or eleven baskets per year. There was no material difference in the size of the trees on the two plots; in both cases they were large, and, for the most part, healthy, even when the experiment was concluded, which was not caused by the normal dying of the trees, but by the fact that the larger number of them were partially or wholly destroyed by a severe windstorm. In the third place it is interesting to observe—and it is a point of great importance—the effect of an abundance of food in overcoming unfavorable weather or seasonal conditions. The year 1889 was extremely unfavorable, and the crop throughout the state was small. In this experiment the unmanured plot yielded at the rate of ten and nine tenths basket per acre, while the manured and fertilized plots both showed a yield exceeding one hundred and fifty baskets

per acre. The manure strengthened and stimulated the trees, and enabled them successfully to resist such conditions as were fatal to the crop on the unmanured land. This point is one that is seldom considered in calculating the advantages to be derived from proper manuring, though it is of extreme value, since the expenses of cultivation, trimming and interest on investment are quite as great in one case as in the other. Another experiment bearing upon this point, recently reported by the Cornell experiment station,* is also very instructive as indicating the need of manures for fruit trees, not only in reference to the amount removed, but also in reference to the proportions of the essential constituents required. This study shows that the plant food contained in twenty crops of apples, of fifteen bushels per tree and thirty-five trees per acre, and in the leaves for the same period, amounts in round numbers to one thousand three hundred and thirty-seven pounds of nitrogen, three hundred and ten pounds of phosphoric acid and one thousand eight hundred and ninety-five pounds of potash. These amounts of plant food are compared with the amounts that would be removed by twenty years' continuous cropping with wheat, assuming an average yield of fifteen bushels of wheat per acre, and seven pounds of straw to three bushels of grain, viz., six hundred and sixty pounds of nitrogen, two hundred and eleven pounds of phosphoric acid and three hundred and twenty-four pounds of potash. By this comparison it is shown that the twenty crops of apples remove more than twice as much nitrogen, half as much again of phosphoric acid and nearly three times as much potash as the twenty crops of wheat. These results, although only applying strictly to the apple, are valuable in indicating the rate of soil exhaustion by fruit-growing. It is to be remembered, however, that the larger root development of the tree would enable it to draw its nourishment from a larger area of soil than is the case with wheat, and thus probably permit of normal growth for a longer period.

THE EXPERIENCE OF PRACTICAL ORCHARDISTS.

The experience of practical fruit-growers, particularly if they are successful, is also of value in this connection.

During the past year statistics were gathered in New Jersey concerning the methods of practice in fruit-growing, and among the questions asked was, "The kind of manure used and the amounts applied per acre." The results obtained are instructive in showing, *first*, that orchardists do recognize the necessity of a liberal feeding of their fruit crops; and *second*, that the rate of

*Bulletin No. 103, "Soil depletion in respect to the care of fruit trees."

profit, other things being equal, is largely dependent upon such a practice, though the methods in use are widely different and in many cases unsystematic and irrational. I have selected those gathered in Burlington county, on pears and apples as illustrations, because they furnish good examples of progressive practice, and because those from other counties have not been finally tabulated. Of one hundred and sixty-nine growers of pears, representing an area of over a thousand acres, one hundred and sixty-two use manures of some kind; fifty-four only barnyard manure, the application ranging from five to fifteen tons per acre annually; forty-one use commercial manures exclusively, the larger part of which consists of ground bone and muriate of potash, the annual application averaging six hundred pounds per acre; thirty-three use barnyard manure and fertilizers together, an average application of eleven tons of the former and six hundred pounds of the latter per acre; thirty-four use miscellaneous home products, including lime, wood ashes, coal ashes, river mud, muck, etc., and seven only of the entire number do not manure at all. Of this whole number, ninety per cent. report that fruit is the most profitable crop that they raise, the gross returns ranging from $50 to $600 per acre, with an average of $150.

Of one hundred and ninety-four growers of apples one hundred and eighty-three use manure; eighty-two barnyard manure exclusively, at the rate of nine tons per acre; thirty both barnyard manure and fertilizer, at the rate of nine and one half tons of the former and five hundred pounds of the latter; twenty-nine use fertilizer alone, chiefly bone and potash, at the rate of seven hundred pounds per acre; eight use barnyard manure and lime, and thirty-four use miscellaneous products. Their average gross returns are about $100 per acre, and practically every grower reports that the crop is a profitable one. We have here a practically unanimity of opinion as to the necessity of using manures, though a wide difference in practice in reference to the kind of material used, which is in many cases due to the relative cost of the various materials rather than to definite opinions concerning their relative value.

THE KIND OF MANURE TO USE.

The kind of manure to use may be discussed, *first*, as to whether it shall be natural or artificial, and *second*, if artificial, the kind of materials and the proportions of the constituents most desirable. In reference to the relative usefulness of yard manure and the best forms of chemical fertilizer the data derived from the experiment on peach trees is instructive, and

I simply add to that already given a financial statement showing the relative values of the crops secured, less actual cost of manures, and which does not include the cost of application.

V—NEW VALUE OF CROPS FROM FERTILIZER AND FROM NATURAL MANURES

	Per year.
Unmanured, ten years, value of crop, $301.85	$ 30 18
Fertilized, ten years, value of crop, less cost of fertilizer, $810.20	81 02
Manured, ten years, value of crop, less cost of manure, $673.70	67 37
Annual net increase from fertilizer	51 02
Annual net increase from manure	37 19

As has been already suggested, the amount of yard manure applied may have been much larger than was necessary, though it is very clearly shown that the use of chemical fertilizer, under the conditions obtaining in the experiment, was relatively more profitable than the manure; hence, while it is hardly safe to conclude that chemical fertilizers may in all cases be more profitable than the manure, it was shown in previous tabulations that chemical fertilizers did practically meet the demands for plant food; that is, the yield was but little greater from the use of barnyard manure. In reference both to the kind of materials and to the proportions of the constituents most desirable, we have to depend rather upon the opinion of experts than upon well ascertained data, though the Cornell experiment, already quoted, is interesting in that it throws considerable light upon the question of proportion of the various constituents. In this connection I shall quote the opinions of leading horticulturists.

In farmers' bulletin, No. 33, of the department of agriculture, on peach-growing, Erwin F. Smith, the author, under the caption "Fertilizers," says: "Some words are necessary on the use and misuse of fertilizers. Unless the trees are on strong land it will be necessary as soon as they come in bearing, and yearly thereafter, to give them each spring or autumn some special fertilizer. There can be no objection to the use of well composted barnyard manure. When this is not procurable dependence must be put on clover and commercial fertilizers, taking care always that the latter are obtained from reliable sources. In general, the dependence should be on potash, salts and phosphates rather than on nitrogenous fertilizers. The peach can be injured readily by excess of nitrogen. Its effect upon the trees is to produce excessive growth of wood and foliage at the expense of the fruit. Fifty to a hundred pounds per acre of nitrate of soda or its equivalent in dried blood or sulphate of ammonia is usually as much nitrogenous fertilizer as any orchard requires, and many

orchards do not need it at all. Muriate of potash, kainit or sulphate of potash may be used in large quantities without injury. Four to five hundred pounds per acre will do no harm, provided it is not put too close to the trunks of the trees." This opinion is based upon the results of studies to determine the relation of fertility to peach yellows, which were not continued for a long period.

In Bulletin No. 72 of the Cornell experiment station, Prof. L. H. Bailey says: "Nitrogen, potassium and phosphoros are the elements which need to be applied to orchard lands. Nitrogen is particularly efficacious in promoting growth. In fact, the amount of growth and the color of foliage are reliable guides for the application of nitrogen. Orchards are grown for fruit, not for forestry purposes. In general, it is better to supply nitrogen by good cultivation — which assists nitrification — and an occasional green manure crop, than by the application of nitrogenous fertilizers. If the orchard is not growing and is yellowish in foliage, good cultivation — begun early and repeated very frequently — in connection with the use of potash, phosphoric acid and green manures, will commonly correct it. Potash is generally the most important element to be applied directly to orchards, particularly after the trees have reached bearing age. The store of available potash in the soil is much increased by the thorough tillage which has already been recommended, but in bearing orchards it should also be supplied every year in some commercial form. In general, phosphoric acid is rather less important in fruit plantations than potash, although this order is reversed in general farming. Potash should undoubtedly be the leading factor in orchard fertilizers, and nitrogen, as I have said, may be obtained mostly by means of tillage and green crops."

Again, in Bulletin No. 74, Professor Bailey says: "I believe that the keynote to the proper fertilizing of peach orchards is potash and phosphoric acid and not nitrogen. Ashes, muriate of potash, bone fertilizers — these are some of the money makers for peach trees. Tillage, with green manure crops at the end of the season, can be relied upon to furnish nitrogen in most instances. I do not wish to disparage the use of nitrogen, for even in bearing orchards a direct application may sometimes be necessary; but I desire to state what I believe to be a fundamental consideration in orchard culture, that nitrogen can easily be used to excess, and that it can generally be obtained by means of tillage and green manure, and also that potash and phosphoric acid need to be annually applied to orchards of bearing age." The points contained in the above statement are again emphasized by Professor Bailey in Bulletin No. 102. These opinions of

Professor Bailey are based largely upon theoretical considerations, verified by his wide observation.

Prof. L. R. Taft, in Bulletin No. 103, of the Michigan Experiment Station, says: "Of the three elements that are often deficient in the soil, potash, phosphorus and nitrogen, it can be said that a rich virgin soil will generally contain all that is needed for an orchard, but after the trees have matured several crops of fruit, the available potash and phosphorus is likely to become so reduced that a satisfactory growth cannot be obtained, and if the soil is in any way deficient in organic matter, the amount of nitrogen will probably be rather small. As a rule, a bearing orchard should have, once in two years, from three hundred to five hundred pounds of ground bone, two hundred to three hundred pounds of muriate of potash, and one hundred and fifty pounds of nitrate of soda per acre; or in place of these, twenty-five tons of decomposed stable manure will be beneficial if the soil is light. In addition to their value for supplying plant food, the chemical fertilizers have an additional value, which is, perhaps, equally important, as by supplying soluble plant food early in the season they enable trees to make their growth during the first of the season, and ripen their wood thoroughly before winter. The growth is, as a rule, much more firm than that obtained by the use of stable manure, or from the natural fertility of the soil. In fact, the chemical manures can be used as correctives, since if those containing potash and phosphoric acid are added to soils that have been highly enriched with stable manure, or that are naturally quite rich in organic matter, they will have a tendency to make the new wood more firm and compact. It can then be claimed that the proper use of chemical manures will increase the hardiness of trees, and will both render the fruit buds less susceptible to sudden changes in the weather and lessen the danger of their winter killing."

These statements, while general, rather than specific in character, agree in their main points: *First*, that orchards should be liberally fertilized; *second*, in giving preference to artificial manures; and *third*, in urging that great care be exercised in the use of nitrogen. Those in reference both to the unfavorable effect of too much nitrogen, and to the importance of superphosphate and potash salts, are in a measure verified by the New Jersey experiment already quoted—that is, nitrogen used alone, and therefore in excess, was not particularly useful, while the combination of phosphoric acid and potash was more serviceable than any other combination of two elements. The nitrogen was, however, of very great value when used in connection with the mineral elements, as the accompanying statement will show.

VI — MONEY VALUE OF CROPS, LESS COST OF MANURE.

	Per year.
Unmanured, ten years, value of crop, $301.85	$ 30 18
Nitrogen alone, ten years, value of crop, $307.30	30 73
Phosphoric acid and potash, ten years, value of crop, $725.65	72 57
Nitrogen, phosphoric acid and potash, ten years, value of crop, $810.20	81 02
Annual profit from nitrogen alone	55
Annual profit from phosphoric acid and potash	42 39
Annual profit from nitrogen, phosphoric acid and potash	50 84
Annual gain from addition of nitrogen to mineral elements	8 45
Annual gain from application of nitrogen alone	55

In this experiment the nitrogen was in the form of nitrate of soda, and because of the ready availability on nitrates, was doubtless all absorbed early in the season, and thus did not encourage late growth of leaf and branch. In this experiment, too, a continuous application of excessive amounts of organic nitrogen, while probably not of the greatest advantage, did not prove detrimental; the wood ripened well, and the fruit, while maturing a little later in some cases, was quite as good as that from trees which received the nitrogen in the form of nitrates.

Suggestions as to the benefits of nitrogenous manuring are also furnished by the following examples of actual practice. I note these particular examples, because I have full knowledge of the facts. One of the most productive and profitable peach orchards in our state is now twelve years old, and at present shows no signs of decay or loss of vitality. This orchard, with the exception of one year, has received annually per acre since the bearing period, at three years of age:—

	Pounds.
Nitrate of soda	200
Ground bone	200
Acid phosphate	200
Muriate of potash	200

The exception noted is, that one year the nitrate of soda was omitted from part of the orchard; this omission, in the opinion of the owner, resulted not only in a considerable loss of fruit for that year, but in a diminution of the vitality of the trees, which was very noticable in the next crop, even though that year fertilized with nitrates as usual. This orchard is situated in the peach region on soil well adapted for fruits, and was in a good state of fertility when the trees were planted. Orchards in the immediate neighborhood that were planted at the same time, and which were either not fertilized at all, or in a very unsys-

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tematic way, have all been removed, either because of the death of the trees, or because the crops received were not sufficient to pay for the labor of caring for the orchard. It may be well to state, too, that this orchard, consisting of ten acres, has produced eight profitable crops; one crop returned a net profit of $200 per acre, while the average net profit for the whole period of the life of the orchard, now twelve years, is over $50 per acre.

Another orchard, situated on a sandy loam soil, which had been fertilized liberally with ground bone and muriate of potash only, showed signs of decay at the age of nine years. The spring of the tenth year a part of the orchard received, in addition to the bone and potash, two hundred pounds per acre of nitrate of soda, and another part was seeded with crimson clover in the fall of the ninth year, which was used as a green manure crop in the spring of the tenth year. The effect of the added nitrogen was very striking; the trees revived, the color of the leaves changed to a dark green, and the fruit increased considerably, so that now, at the age of thirteen years, this fertilization having been continued in the meantime, it presents a healthy and vigorous appearance.

The third example is furnished by a pear orchard of ten acres, which has not missed a full and profitable crop since it came into bearing, now more than ten years, and is fertilized annually with one half ton of an even mixture of ground bone and muriate of potash; it received nitrogen in the form of nitrate of soda in the earlier stages of its life, while for the past five years the nitrogen has been supplied through the means of green manures.

The practice of the Burlington county farmers is also in evidence as to the benefits of large and continued applications of nitrogen, in the form of barnyard manure, since more than one third of the whole number represented use this exclusively, while nearly all who use it find the practice profitable. It would seem, therefore, that the advantage of nitrogenous manuring is sufficiently well established, and that the chief questions are as to the kind of nitrogen and the best methods of use. In the first place, the character of the soil must guide here, since soils differ both in their physical and chemical character, and hence in their ability to supply food. Sandy soils with sandy or gravelly subsoils represent a large class; they possess a fairly good physical character, but are very deficient in vegetable matter containing nitrogen, and in the mineral constituents, phosphoric acid and potash. On these, nitrogen supplied in the form of vegetable matter has proved of great advantage, both directly in furnishing nitrogen, and indirectly in improving the physical character of the soil, though it must be accompanied by an abundance of the mineral constituents, phosphoric acid and

potash. If applied in the form of nitrate on this class of soils, their is great danger of loss from leaching. Sandy or clay loams overlaying clay subsoils of medium porosity represent another class. These are frequently of good texture, and richer in both humus and mineral constituents than the sandy. With good cultivation fruits make a normal and healthy growth, and do not show the need of nitrogen until crops are harvested; they are then much benefited by it, and it may be most economically applied, in the form of nitrates, particularly if added in connection with the mineral constituents, phosphoric acid and potash.

The third class includes those which possess good physical qualities combined with a high natural strength, which comprise a relatively small area. Where such soils have not been subjected for a long time to exhaustive cropping, the growth and development of both tree and fruit proceed normally with minimum applications of manures. In the second place, the natural mode of growth and development of the tree should guide in the use of nitrogen. In all cases there should be sufficient nitrogen to provide for an abundant leaf growth early in the season, since the tree and fruit are dependent for food upon both the leaves and the roots. The supply of nitrogen, however, should be limited late in the season, or the foliage will hold too long, with a consequent late feeding, and the result that the new wood formed will lack hardness and maturity.

PRACTICAL SUGGESTIONS.

A system of manuring for cultivated orchards, based upon the limited data at our disposal, may be outlined as follows: To provide vegetable matter and to improve the physical quality of poor soils, apply yard manure once in four years, in fall or winter, at the rate of from five to ten tons per acre. To aid in the decomposition of vegetable matter, and to insure a sufficiency of lime as plant food, apply lime at the rate of 25 bushels per acre once in five years. To provide, in addition, an abundance of all forms of available plant food at the times needed for the development of the tree and fruit, apply annually chemical fertilizers in the following proportions:—

	Pounds.
Nitrate of soda	100
South Carolina rock superphosphate	100
Ground bone	200
Muriate of potash	200

The amounts to be applied depend upon the character of the soils, as previously outlined, the kind of fruit and the age and vigor of the trees; these given, perhaps, mark the minimum. In a number of the best orchards the quantities applied are very much larger than is here indicated, and the larger application is believed by the growers to be proportionately profitable. By the recent introduction of crimson clover, we have a plant admirably adapted to supply cheaply nitrogenous vegetable matter for orchards, and its growth is to be recommended wherever the plant can be successfully grown, instead of the use of barnyard manure, particularly upon the poorer soils, until they are abundantly supplied with vegetable matter. The clover should be ploughed down early in the season, in order not to retard the spring growth of the trees. Where the conditions are favorable for the growth of clover, the application of nitrate of soda may be omitted.

I have in this paper presented, as fully as my time allows, what in my judgment seems to be reliable information bearing upon the subject, and a careful review shows that it only emphasizes the statement made in the beginning, that there is urgent need of studies and investigations concerning the food requirements of the various fruits.

THE TREE—ITS NUTRITION AND GROWTH.

By PROF. E. R. LAKE, Corvallis, Oregon.

A tree, embodying all the functional activities of a vegetable organism, is the acme of plant life. The principles and processes of nutrition of such an organism are vitally important to the orchardist; for, upon the proper performance of these latter depends, not only the welfare of the tree, but the success of the orchardist as well; while a comprehensive knowledge of the former places him in a position to supplement natural conditions favorable to plant nutrition or to allay or modify those conditions that are unfavorable to its best growth and development. To obtain a thorough understanding of vegetable nutrition and growth one must have a well-grounded knowledge cf plant structure, including the cell, its make-up, growth and multiplication. In a short paper for our purpose, detail discussion on this point cannot be considered, but a few broad, general statements regarding the cell may be of use in the better understanding of what follows.

The Cell.—All organized structures, plant and animal alike, originates in minute vesicles or cells, as they are called. If a seed or fruit, piece of plant or animal be examined with a microscope it will be found to be composed of a mass of rounded or many-sided bogs or cells, lying close together, and more or less filled with liquid, or in the resting period of seeds, quite solid matter. From the cellular moss of the seeds of higher plants comes the plant. In the lower plants and animals the seeds—known as spores—are only one-celled and some whole plants for that matter are composed of only one cell. In the growth of the individual of our higher plants the cells are vastly multiplied, their forms greatly modified and their sizes as varied as the uses for which they are created; but throughout all the parts of an animal or plant the distinguishing characteristics of the cell are readily determined and the structure is said to be cellular. When similar cells are united firmly into a mass, it is called tissue. Tissues vary in both structure and function. The walls of all cells are more or less penetrable by liquids, and weak, watery solutions of minerals in the soil are not only able to pass through the wall into the interior of the cell, but may also traverse the cell

walls. The passage of liquids from the outside to the interior of a cell and from one cell to another depends largely upon the laws of osmose and diffusion and atmospheric pressure. It is a well-known law in physics that if two miscible liquids of unequal density are separated by a porus membrane, such as a cell wall, enough of each will pass through the membrane and diffuse through the other to ultimately bring both to the same density. Then, again, if from one of two adjoining cells, charged to their full capacity with equally dense contents, a portion is removed, diffusion from the other takes place till the equilibrium is again established; if this loss should be from one cell in a mass, then each of the other cells would have its contents reduced by such a proportionate amount of the liquid removed from the first cell, as the one cell is a part of the whole tissue.

In the tree there is a zone of active cells just inside the rough bark, and varying in thickness with the age and size of the tree, from one quarter of an inch, or even less, to five or six inches. This zone is commonly known as the sapwood and inner bark. The heart wood and the rough outside bark are composed of dead cells. Between the inner bark and the youngest wood is a very narrow band of thin-walled cells, called the cambium. This is the zone of active growth. At this place is formed the annual layer of wood and bark, and during the growing season the cells here are very soft, very turgid, very active and rich in formative material.

The Nutrition.—The plant, *i. e.*, the ordinary agricultural plant, derives its food from the air and soil. The chief element in plant structure is carbon, and this is derived almost wholly from the air through the leaves of the plant. About 50 per cent. of the tree as it is growing is carbon; 45 per cent. water; five per cent. mineral and other matters.

The leaves are chiefly composed of thin-walled, irregular cells, which are not closely coherent, but have large and numerous inter-cellular spaces interspersed among them. Where these inter-cellular spaces lie between two or more cells at the surface of the leaf there is usually a small opening, which, together with three or four small cells in the epidermis of the leaf, is called a stoma. This stoma has the power of enlarging or diminishing the width of the opening in accordance with the demands of the plant, or the condition of the atmosphere. It has been estimated that from 20,000 to 120,000 of these openings or stomata are to be found on a square inch of leaf surface. They are usually, and sometimes wholly, found on the under surface of the leaf. The functions of the stoma appear to be the admission of gases, principally carbonic acid, oxygen and a small quantity of ammonia into the plant organization, and the providing of means

for the escape of watery vapor and gases from the interior of the plant.

In the outer cells of normal leaves are small granular bodies of greenish matter known as chlorophyll (klor-o-fill). The granules are so numerous as to give the whole mass a greenish color, more or less dense, according to the variety of plant, the health, vigor of growth or age of the individual. This chlorophyll, which is only a part of the contents of the surface cells of leaves and branches, is the digestive organ of the plant. The carbonic acid gas of the air, entering through the stomata, passes into the interior of the plant by means of the inter-cellular spaces; is absorbed by or diffuses through the cell wall, comes in contact with the chlorophyll granules, and is consumed. The first change noticed in these color masses, after the gas comes in contact with them, is the appearance of starch granules. Starch is the product of carbonic acid acted upon by chlorophyll. The starch, however, does not long retain its individuality. It is scarcely more than produced before it is dissolved in the semi-liquid contents of the cell, the more solid portion of which, as a whole, is called protoplasm.

In time, of course, the cell becomes highly congested with this material, and then the laws of osmose and diffusion begin to operate and a portion passes out through the cell walls into surrounding cells; from there a portion may pass on to other cells, and so on until the terminal cells of both root and stem have been reached. At the same time that the carbon is being assimilated by the chlorophyll granules, the oxygen, which is united with it to form the carbonic acid gas of the air, is set free and escapes through the stomata to the outer air. So much for the course of the plant's chief element of food.

But while this process is going on in the leaves, a no less important process is going on in the young cells of the roots. When the food stored up in the seed for the growth of the young plant is exhausted, there is provided in the young cells of the root an acid, which, permeating the cell walls, oozes out, as it were, and corrodes or digests the soil immediately in contact with the cell walls. The digested or dissolved minerals become diffused in the soil water, a more or less quantity of which is at all times present and surrounding the soil particles. This watery solution is readily absorbed by the young root cells, when not containing more than one part mineral to 10,000 parts of water; in other words, the watery solution of the soil being denser than the cell contents, *i. e.*, an equal quantity of the soil having more of certain mineral matters in it than is in the contents of the cell, it diffuses into the cell. This causes the outside cells to become gorged. With the increase of cell contents there comes

increased density and increased pressure on the cell wall, and then follows the process of diffusion into the interior cells, and so on until an equilibrium is reached, which, under normal conditions, is not until the close of the growing season; for, while water is being taken up by the roots, it is likewise being evaporated at the leaves.

Through the stomata there is, under normal atmospheric conditions, the constant escaping of watery vapor. To meet this loss from the leaf cells, equal quantities are diffused from within and below. This results in a steady upward current of water, from root to leaf, during the active growing season of the plant. This water, which holds in solution more or less mineral matter and gases, traverses the cell walls through the greater part of the length of the stem.

Some portion of it is diffused into the cells along its course, but the greater portion of the water is conducted to the outer leaf cells, where most of the water is thrown off and the mineral matter and gases used in the manufacture of plant food.

The food of the plant, that is, the elaborated product of the digestive processes, is separated into two classes: Carbohydrates or those substances derived from the digestion of carbonic acid by the chlorophyll granules; and proteids, those substances which are derived from a union of some carbohydrate with nitric acid and sulphuric acids and some mineral matters, materials derived from the soil in the watery solutions. Among the carbohydrates are starch, sugar, cellulose and fats. The proteid substance, with which we are most concerned, is the protoplasm. This is the formative substance; the first life; the active element of plant growth. It permeates every active living cell and is particularly abundant in the youngest cells of all growing parts. Just where this substance is formed is a debatable question, but so far as our best botanists can determine, it is formed in or near the larger ducts or sieve tubes, as they are called, but it may be, and probably is, formed in other cells, as in the outer cells of the leaf and in the thin-walled cells of the wood tissue.

At any rate, it is the various matters held in the watery solutions taken in by the roots that, uniting with the carbohydrates of various cells forms the proteid matter of the plant. This matter when formed in certain cells increases the density and pressure of such cells and in consequence diffusion follows. When being transferred for considerable distances it appears to be conducted along the sieve tubes, a series of ducts or tubes having perforated cross walls only at relatively long intervals, thus allowing a rapid and quite uninterrupted passage of this material from one part of a plant to another, which may be quite a distance from the starting point.

The Growth.—The increase in size and substance of a plant, independent of nutrition, is a process of vital significance to the plant culturist. That growth may take place at a time when the processes of nutrition are inactive, is quite evident in the growth of plantlets from seeds, tubers, cuttings, roots, etc. That almost the reverse is equally true, is alike evident in the disposition of food materials in the various tissues already fully grown and matured. For example, after the elongation and enlargement of twigs, shoots, branches and stems have ceased for the season, the processes of nutrition are even more active than earlier in the season. The tissues that are formed in the early spring,—and who has not observed that the trees of our climate make their greatest growth during the first two or three months of their leafage,—are produced at the expense of the reserve food material within the older tissues of the tree,—material accumulated the previous year.

The food manufactured by the leaves during their earliest stages is but a modicum compared to the amount used in the structure of new tissue during the same period. And thus it is, after growth has been completed in a given season, that the nutritive processes continue active and large amounts of food, chiefly in the forms of starch and sugar, are stored in the various tissues of the plant—reserve material for the early stages of growth the succeeding year.

Occasionally growth continues too late in the season, due to unusual or exciting causes and resulting in leaving immature shoots or branches to winter over and lessening the amount of reserve material for early spring growth the following year. Disease, sooner or later, results from this abnormal condition, and frequently death to a large part of the tree may come the following winter or spring. Late cultivation, early fall rains, followed by a period of warm, growing weather, are exciting causes and quite sufficient to induce undesirable late growth. These are leading conditions against which the orchardist must guard his trees. Other inferences each cultivator will draw for himself.

ECONOMY IN THE USE OF IRRIGATION WATER.*

By E. W. HILGARD and R. H. LOUGHRIDGE.

The exceptionally dry season of 1897–98, coupled with the early cessation of rains in the spring of 1894, have brought about in California a more extended failure of cereals and pasturage, and shallow rooted crops generally, than in any year since the state became a prominent agricultural one, the season of 1876–7 being the nearest to carry with it a similar deficiency in crop production. It has been the effort of the experiment station to utilize the present unusual season for the study of the limits of endurance of drought on the part of the several crop plants, and with it to determine the minimum of water that will suffice for their satisfactory growth in the several soils. While far from completed, this work (involving many hundreds of determinations of moisture in soils) has already yielded some results which render it desirable that they should be placed before the farmers and discussed at once in order to provide against a recurrence of avoidable injury in the future.

Amount of water required by crops.—It is not very generally understood how large an amonnt of water is required for the production even of fair crops, for the maximum of possible product is rarely obtained on a large scale because it is not often that all conditions are at their best at any one time and locality. But from numerous observations, made both in Europe and in the eastern United States, it has been found that from three hundred to over five hundred tons of water are on the average required to produce one ton of dry vegetable matter. In Wisconsin, King found that a two-ton crop of oat hay required over one thousand tons of water per acre, equal to about nine inches of rainfall. The average rate for field crops at large is given by European observers at three hundred and twenty-five times the weight of dry matter produced, being at the rate of about three inches of rainfall actually evaporated through the plant.

These data should enable us to estimate the adequacy of the moisture contained in the soil at the beginning of the dry season

*Applicable to Snake river, Eastern and Southern Oregon.

to mature the crop, provided we make due allowance for any growth already made at the time, and provided also that the estimates as to the water requirements derived from the experience of the countries of summer rains (the humid regions) hold good for the arid region also. Whether or not this can be assumed is among the points our experiments are designed to determine. The surprisingly successful growth and bearing especially of deciduous trees, without irrigation, despite a drought of five or six months in the "Franciscan climate,"* has led to an impression that a less amount of water may suffice under arid conditions. For in the east as many weeks of drought and intense heat would frequently suffice to destroy the crop.

Probable causes of this endurance of drought.—Doubtless the main cause of this remakable endurance is to be found in the much deeper rooting of all plants in arid climates, whereby not only a much larger bulk of moist soil is at their command but the roots are withdrawn from the injurious effects of the hot, dry surface and air.

This deeper range of the roots is not the result of foresight on the part of the plant. It could not occur on eastern soils, because of the intervention, in a great majority of cases, of difficultly penetrable subsoils, from which, moreover, plants could draw but little nourishment on account of their "rawness." In the arid region, as a rule, subsoils in the eastern sense do not exist; the soil mass is practically the same for several feet and in the prevalent soils is very readily penetrable to great depths. This, summarily speaking, is due to the slight formation of clay and the rarity of heavy rains in the arid region. And this easy penetrability of the soil implies, moreover, that being well aerated the depths of the soil are not "raw," as in the east, and therefore that the "subsoil," such as it is, may fearlessly be turned up as deeply as the farmer is willing to go with the plow without danger of injuring the next season's crop in all lands that are well drained, as by reason of their depth and perviousness is the case with most California soils.

The accompanying plate illustrates from nature the deep penetration of a peach root developing in a normally deep, well aerated "bench" soil in a manner quite impossible to the same root when growing in land underlaid, as are most eastern ones, by a subsoil which either is too dense or too wet to be penetrated and utilized by the tree.

A glance at the figures suffices to show that while a root system

* This name has been felicitously applied by Powell to the climate of Middle and Southern California, which is characterized by the concentration of rains within a winter which is mild enough to constitute a growing season, while the summer is practically rainless.

like plate 1, a typical eastern tree root (as given by Thomas' Fruit Culturist, page 82) will stand in absolute need of frequent rains or irrigation to sustain its vitality; such a one as plate 2 may brave prolonged drought with impunity, being independent of surface conditions and able to perform all its functions out of reach of stress from lack of moisture.* It is equally clear that it is to the farmer's interest to favor, to the utmost, this deep penetration of the roots, both in the preparation and tillage of the ground, and in the use of irrigation water. For if the latter is used too frequently or too abundantly, the salutary habit of deep rooting will be abandoned by the plant, and it will, as in the east, be dependent upon frequent rain or irrigation; and also, owing to the small bulk of soil upon which it can draw for its nourishment, upon frequent and abundant fertilization.

Eastern immigrants, as well as a large proportion of California farmers, do not realize the privilege they possess of having a triple and quadruple acreage of arable soil under their feet, over and above the area for which their needs call; and they tenaciously continue to adhere to precautions and practices which, however salutary and necessary in the region of summer rains, do not apply to this climate. The shallow plowing so persistently practiced results in the formation of a "plowsole" that plays the part of the eastern subsoil in preventing root penetration, limiting their range for moisture and plant food, and thus naturally causing crops to succumb to a slight stress of season which ought to have passed without injury had the natural conditions been taken into proper consideration.

Roots follow moisture.—Very striking examples of deep rooting as the result of vertical moisture penetration can be observed in some of our native trees, which, while naturally at home on moist ground, are nevertheless sometimes found forming luxuriant clumps on the slopes and even summits of our coast ranges and foothills. If we examine the ground where this occurs in the case of California laurel, we will generally find that the soil in which they grow is underlaid by slate or shale standing on edge, into the crevices of which the roots penetrate, wedging them open, while themselves flattening out, and thus penetrating to moisture at considerable depths. The same may be observed in the case of the erect "bedrock" or foothill slates of the Sierras, on which native as well as fruit trees flourish in very shallow soils, sometimes reaching permanent moisture at the depth of ten or more feet below the surface. It can readily be observed during rains that there is comparatively little run-off from the surface of these lands underlaid by vertical shales.

* The moisture determination under this tree gave to the depth of eight feet an aggregate amount of water of 1,058 tons per acre.

On the same principle the grape vines which bear some of the choicest raisins of Malaga on the arid coastward slopes, are made to supply themselves with moisture, without irrigation, by opening around them large, funnel-shaped pits, which remain open in winter so as to catch the rain, causing it to penetrate downward along the taproot of the vine in clay shale quite similar to that of the California coast ranges, and like this latter almost vertically on edge. Yet on these same slopes scarcely any natural vegetation now finds a foothold.

Similarly the "ryots" of parts of India water their crops by applying to each plant immediately around the stem such scanty measure of the precious fluid as they have taken from wells, often of considerable depth, which form their only source of water supply. Perhaps in imitation of these, an industrious farmer has practiced a similar system on the high benches of Kern river, and has successfully grown excellent fruit for years on land that originally would grow nothing but cactus. Subirrigation from pipes has been applied in a similar manner.

The principle flowing from the above is simply that the most economical mode of using irrigation water is to put it "where it will do the most good," close to the stem of the plant or trunk of the tree, and let it soak downward so as to form a moist path for the roots to follow to the greatest possible depth. It is this deep penetration to natural moisture, as a matter of fact, which enables the small quantities supplied to produce such marked effects.

Basin irrigation.—It will be noticed that this principle is practically the same as that of the basin irrigation of orchards, which was originally largely practiced in California, but has now been mostly abandoned for furrow irrigation. The latter has been almost universally adopted, partly because it requires a great deal less hand labor, partly under the impression that the whole of the soil of the orchard is thus most thoroughly utilized; partly also because of the injurious effect upon trees produced at times by basin irrigation.

The explanation of such injurious effects is, essentially, that cold irrigation water depresses too much the temperature of the earth immediately around the roots, and thus hinders active vegetation to an injurious extent, sometimes so as to bring about the dropping of the fruit. This, of course, is a very serious objection, to obviate which it might be necessary to reservoir the water so as to allow it to warm before being applied to the trees. In furrow irrigation the amount of soil soaked with the water is so great that the latter is soon effectually warmed up, besides not coming in contact too intimately with the main roots of the tree, along which the waters soaks very readily

when applied to the trunk, thus affecting their temperature much more directly. It is for the fruit-grower to determine which consideration should prevail in a given case. If the water supply be scant and warm, the most effectual use that can be made of it is to apply it immediately around the trunk of the tree, in a circular trench dug for the purpose. When, on the contrary, irrigation water is abundant and its temperature low, it will be preferable to practice furrow irrigation, or possibly even flooding. As to the more complete use of the soil under the latter two methods it must be remembered that while this is the case in a horizontal direction, yet unless irrigation is practiced rather sparingly under the furrow system, it may easily happen that the gain made horizontally is more than offset by a corresponding loss in the vertical penetration of the root system. This is amply apparent in some of the irrigated orange groves of Southern California, where the fine roots of the trees fill the surface soil as do the roots of maize in a corn field of the Mississippi states; so that the plow can hardly be run without turning them up and under. In these same orchards it will be observed, in digging down, that at a depth of a few feet the soil is too water-soaked to permit of the proper exercise of the root functions, and that the roots existing there are either inactive or diseased. That in such eases abundant irrigation and abundant fertilization alone can maintain an orchard in bearing condition, is a matter of course; and there can be no question that a great deal of the constant cry for the fertilization of orchards in the irrigated sections is due quite as much to the shallowness of rooting induced by overirrigation, as to any really necessary exhaustion of the land. When the roots are induced to come to and remain at the surface, within a surface layer of eighteen to twenty inches, it naturally becomes necessary to feed these roots abundantly, both with moisture and with plant food. This has as naturally led to an overestimate of the requirements of the trees in both respects. Had deep rooting been encouraged at first, instead of overstimulating the growth by surface fertilization and frequent irrigation, some delay in bearing would have been amply compensated for by less of current outlay for fertilizers, and less liability to injury from frequently unavoidable delay, or from inadequacy of irrigation.

CONSERVATION OF SOIL MOISTURE.

Alongside of economy in the use of irrigation water, the conservation of the moisture imparted to the soil either by rains or irrigation is most important; critically so where irrigation is unavailable.

Utilization of winter rains and winter irrigation.—However strong

is the popular demand for storage of the winter rainfall and flood waters, too many do not appreciate the importance of the storage they can command without the use of reservoirs, within their own soil mass. While there is a well-grounded objection to subjecting plowed land to the leaching action of the abundant rains in the humid region, no such objection holds in the case of lands lying within the limits of 20 to 25 inches of annual rainfall. Here the absorption of the winter rains should be favored to the utmost, for the run-off is mostly a dead loss. Fall plowing, wherever the land is not naturally adequately absorbent, and is not thereby rendered liable to washing away, is a very effectual mode of utilizing the winter's moisture to the utmost, so as to bring about the junction of the season's moisture with that of the previous season, which is generally considered as being a condition precedent for crop production in dry years. The same, of course, holds true of winter irrigation, the frequent omission of which in presence of a plentiful water supply at that season is a prolific cause of avoidable crop failures. Moistening the ground to a considerable depth by winter irrigation is a very effective mode of promoting deep rooting, and will thus stand in lieu of later irrigations, which, being more scant, tend to keep the roots near the surface.

Knowledge of the subsoil.—It cannot be too strongly insisted upon that in our arid climate farmers should make themselves most thoroughly acquainted with their subsoil down to the depth of at least four, but preferably six or eight feet This knowledge, important eno gh in the east, is doubly so here, since all root functions are and must be carried on at much greater depths. It is hardly excusable that a business man calling him elf a farmer should omit the most elementary precaution of examining his subsoil before planting orchard or vineyard, and should at the end of five years find his trees a dead loss in consequence of an unsuitable subsoil. Similarly, no irrigator should be ignorant of the time or amount of water it takes to wet his soil to a certain depth. We have lately seen a whole community suffering from the visible decline of the thrift of its fruit trees, which occurred despite what was considered abundant irrigation, *i e.*, allowing the water to run for a given length of time, deemed to be sufficient. Yet on being called in to investigate the causes of the trouble, the station staff found that the irrigation water had failed to penetrate during the allotted time to any beneficial extent, so that the trees were, in the main, suffering from lack of moisture—a fact that could have been verified by any one of the owners concerned, by simply boring or digging a hole or two. But no one had thought of doing so, and all kinds of mysterious causes were conjectured to be at work in the suffering orchards.

A definite knowledge of the rapidity with which irrigation water penetrates downward and sideways in his soil should form a part of the mental equipment of every irrigator, particularly in arranging his head ditches. For in sandy lands it may easily happen that when these are too far apart, the water near the head ditch is already wasting into the country drainage at the depth of ten or twelve feet, before any has reached the end of the furrows, or has wetted the lower half adequately. Many such cases come under our observation, and such ignorance of the conditions governing one of the most important factors of success is hardly excusable in anyone. Nor is the quality of the water used indifferent in this connection; for waters containing alkali will fail to penetrate the soil as quickly as would ordinary stream waters.

Preventing evaporation.—But supposing the moisture to have reached the depths of the soil, whether from rains or from irrigation, it is essential that proper means be employed for retaining it in the land and especially to prevent evaporation. That this is best accomplished by a mulch on the surface and that the best mulch for the purpose, which need not be hauled on or off and is always ready, is a surface layer of loose, well-tilled soil, is now pretty well understood by all. But the extent to which the presence or absence of such a nonevaporating layer influences plant growth and fruit production in a critical time is not so fully appreciated. Plates 3 and 4, at end of bulletin, give an illustrative example of trees and fruit grown this season on adjacent fields, with only a lane between, the soil and all natural conditions being absolutely identical, the only difference being the presence and absence of cultivation. In the present case the cultivation was omitted on principle by one owner, who considered cultivation superfluous on the loose, generous soil of Alameda creek; while his neighbor, across the way, held the opposite belief and this season cultivated to an extra depth to conserve moisture. The cultural results are sufficiently shown in the plates and need no comment, although it may be of interest to mention that the year's growth on the one hand was over three feet, on the other barely three inches. The effect on the fruit is shown in plate 4. The determination of the moisture held by the soil in July to the depth of six feet gave the following results:—

Depth of soil.	Cultivated.		Uncultivated.	
	Per cent.	Tons per acre.	Per cent.	Tons per acre.
First foot	6·4	128	4·3	86
Second foot	5·8	116	4·4	88
Third foot	6·4	128	3·9	78
Fourth foot	6·5	130	5·1	102
Fifth foot	6·7	134	3·4	68
Sixth foot	6·0	120	4·5	90
Total for six feet	6·3	756	4·2	512

The difference of 244 tons per acre of ground shown by the analyses is quite sufficient, according to the data given at the beginning of this bulletin, to account for the observed difference in the cultural result. The cause of this difference was that in the uncultivated field there was a compacted surface layer several inches in thickness, which forcibly abstracted the moisture from the substrata and evaporated it from its surface, while the loose surface soil on the cultivated ground was unable to take any moisture from the denser subsoil. This is well illustrated by the familiar fact that while a dry brick will suck a wet sponge dry, a dry sponge (corresponding to the loose surface soil) is unable to take any water from a wet brick. Besides, the tilled surface soil forms a nonconducting layer protecting the subsoil from the sun's heat and the dryness of the air.

In the east, where this principle is well understood, it is considered that a surface layer three inches in thickness is sufficient to afford effective protection. But what is adequate in the region of summer rains is quite insufficient in California and in the arid region generally. It takes fully twice the thickness mentioned, and preferably more, to afford protection against the drought and heat, lasting five or six months at a stretch. Here, again, we find an important point in which our practice must differ from that of the east and the old world.

The beneficial effects of summer fallow in California are assuredly due quite as much to the conservation of moisture brought about by the tilled surface layer as by the weathering of the soil to which the efficacy of the fallow is commonly ascribed. Witness the fact that weeds come up freely on summer fallow as late as August, when unplowed land is as bare as a barn floor.

Similarly on our mostly new and unexhausted lands, the bad effects of weed-growth are doubtless due fully as much to the waste of moisture going on through their leaves as to the competition with the crop in plant food. Hence all good orchardists

are very careful about keeping their ground clean in summer; but it must not be forgotten that by doing so they quickly deplete their lands of vegetable matter, which requires systematic replacement if production is to continue normally. Yet of the two evils, the loss of moisture is more to be dreaded, and very generally in practice the more difficult to remedy.

CULTIVATED.

UNCULTIVATED.

Plate 3.—APRICOT TREES.

CULTIVATED. UNCULTIVATED.

Plate 4.—FRUIT FROM APRICOT TREES.

OLD ORCHARDS.

By John Minto

By old orchards is meant orchards that have been in bearing from twenty to forty-five years, and during twenty or more years have not been treated once by their owner as though they were living organisms, subject to being preyed upon by natural parasitic enemies, as all created beings seem to be, especially when they are poor or in ill health, which often means the same thing.

The old orchards in Oregon are survivals from earlier or later days, in which Oregon was spoken of in the mining camps of the Pacific coast as "the land of big red apples," and yet cover from twenty per cent. to twenty-five per cent. of acreage in orchards in Oregon. Where there is yet in existence such apple orchards on deep, natural-drained clay loam, a few years of profitable production may be got from them by a thorough system of pruning, top dressing, cultivation and spraying.

It will generally be found where an apple or pear orchard is so situated that the branches are interlocked and partly diseased or dead and infested with insect and fungus parasites of many kinds the roots will be found to be interlocked also, as it is a very general law that the feeding roots of an apple tree will on good ground extend further from the bole of the tree in every direction than the topmost shoot of the tree is from the surface of the ground. The result is that at thirty-three feet apart the feeding roots of a neglected orchard of apples will often be occupying the vacant spaces among the roots of adjoining trees, gathering up barely sufficient of the constituents of wood, leaves and fruit to keep life in the trees and give a defective semblance of the apples they once bore.

Inspection develops the fact that one fourth of the orchards in the oldest settled districts of Western Oregon are of old apple trees in bad condition. These occupy not one seventh of the acreage now in orchards intermixed with them, but, where neglected they are breeding beds of parasitic enemies of fruit and fruit trees their age and long neglect tends to foster.

There are two courses open to the self-respecting owner of such property: *First*, he may dig up and burn up the old trees, and

plant a new orchard on new ground; or, *second*, if his trees are yet vigorous and stand on deep, strong, well-drained land, they may be pruned, fed by top dressing, cultivated and sprayed.

As it would not be safe to medicate a sick person without knowing what ailed him, so the best way to intelligently renovate an old orchard is to know, approximately at least, what constituents of good fruit and thrifty trees has been taken from the soil by 20 years or more of bearing without manuring or other care. For this purpose I copy the tables of chemical tests made at the experiment station of Cornell university from Bulletin No. 103 of its horticultural division; every care seems to have been taken to get correct results. Suffice it to say, that every precaution was taken to prevent any change from evaporation or other causes between the time of picking and the time when they were handed over to the chemist,* October 1, for analysis:—

TABLE I.

Leaves from a Wagener apple tree 13 years old, 18 to 20 feet high. Total weight of leaves, 33·15 pounds. Composition of original substance—water, 47·98 per cent.; dry substance, 52·02 per cent.; ash, 9·53 per cent.; nitrogen, 1·85 per cent.; phosphoric acid, 0·488 per cent.; potash, 1·76 per cent.

The above table shows from the small per cent. of water that the leaves had performed their full functions, and that no more changes in the ash content were like to take place.

The handbook of experiment station work gives the composition of apple leaves collected at various times as follows:—

TABLE II.

	Water.	*Ash.*	*Nitrogen.*	*Phosphoric acid.*	*Potash.*
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
In May	72·86	2·33	·74	·25	·25
In September	60·71	3·46	·89	·19	·39

If the leaves of the tree experimented with had been collected in May and had contained as much water as is shown in the last table, there would have been 50 pounds instead of 33·18 pounds. It is probable that the first table shows more nearly than the second the percentages of fertilizing constituents taken from the soil by the leaves.

The following table gives the total weight and content of the leaves of the single apple tree, and also the amount of plant food contained in an acre of like character, assuming that the trees were set 35 feet apart, which would give 35 trees per acre:—

*The analytical work of this bulletin was performed by Mr. G. W. Cavanaugh, under the direction of Prof. G. C. Caldwell.

TABLE III.

	Single tree.	Amount per acre.
	Pounds.	Pounds.
Total weight of leaves	33·18	1,161·3
Total weight of water	15·92	557·2
Total weight of dry matter	17·26	604·1
Total weight of nitrogen	·29	10·15
Total weight of phosphoric acid	·08	2·80
Total weight of potash	·28	9·80

Assuming that 35 trees would bear, in five years from the time they were 13 years of age, 25 bushels of apples per tree or five bushels to the tree per year, and assuming that the composition of the apples was as given below, the results reached are:—

TABLE IV.

Average composition of apples.

	Per cent.
Water	85·8
Nitrogen	0·18
Phosphoric acid	0·01
Potash	0·19

TABLE V.

Amount and value of fertilizing material used by the leaves and fruit in the first period of five years.

	Apples.	Leaves.	Value.
	Pounds.	Pounds.	
Nitrogen	55·4	50·75	$ 15 92
Phosphoric acid	4·25	14·00	1 28
Potash	80·95	49·00	5 85
Total value			$ 23 05

Assuming that in the next five years, the trees would bear 10 bushels per year, or 50 bushels per tree in all, and that the leaves had increased in the same ratio as the apples, the following results are reached for the second five years:—

TABLE VI.

	Apples.	Leaves.	Value.
	Pounds.	Pounds.	
Nitrogen	110·8	101·50	$ 31 85
Phosphoric acid	8·50	28·00	2 56
Potash	161·90	98·00	11 69
Total value			$ 46 10

Assuming that the trees have reached fair maturity at twenty-three years from setting, and that they produce on an average fifteen bushels of apples per tree per year for the next ten years, and that the leaves have increased correspondingly, the following results are reached for the third period of ten years: —

TABLE VII.

	Apples.	*Leaves.*	*Value.*
	Pounds.	*Pounds.*	
Nitrogen	332·40	304·50	$ 95 54
Phosphoric acid	25·50	84·00	7 67
Potash	485·70	294·00	35 09
Total value			$ 138 30

The following table gives the total plant food in leaves and fruit and its value for a single acre (nitrogen, phosphoric acid and potash being computed in all cases at fifteen, seventeen and four and five tenths cents per pound, respectively), for the whole bearing period of twenty years, from the time the tree was thirteen years old from setting until it was thirty-three years old: —

TABLE VIII.

	Apples.	*Leaves.*	*Value.*
	Pounds.	*Pounds.*	
Nitrogen	498·60	456·75	$ 143 30
Phosphoric acid	38·25	126·00	11 50
Potash	728·55	441·00	52 63
Total value			$ 207 45

While the above results are reached by assuming a given amount of apples and leaves per year in a bearing orchard, and while the facts in any given case at any given time may vary widely, yet it is believed that they are valuable, as they furnish a means of measuring in any given case, with a great degree of accuracy, the amount of soil exhaustion.

Table V shows that five bushels of apples remove, in round numbers, eleven pounds of nitrogen, nearly one pound of phosphoric acid and sixteen pounds of potash, and that the leaves of a tree large enough to produce the apples would contain ten pounds of nitrogen, nearly three pounds of phosphoric acid and ten pounds of potash, or a total of twenty-one pounds of nitrogen, three pounds of phosphoric acid and twenty-six pounds of potash.

I have quoted thus freely, from these valuable experiments of Cornell university, to show the old orchard owners of Oregon,

approximately, what has been going on under their trees for the past forty years in some cases, and why their trees are no more like the same trees of long ago than a man, long reduced by gradual starvation, while still possessing the semblance of a man, is like the same man healthy, vigorous and well fed. I quote table XX of these experiments to show how much more a twenty-years' cropping for apples takes from the soil than the same period of wheat cultivation in money value of fertilizing ingredients, while wheat must be fertilized for: "Total value of wheat and straw for twenty years, $128.23; total value in apples, fruit and leaves for twenty years, $207.45."

The basis of these calculations is the average yield of wheat in New York and the average yield of apples from the age of thirteen to thirty-three years. The $62.22 drawn from the soil above the sum extracted by the wheat crop may approximate the deeper reach of apple-tree roots, and we have the facts of orchards dying earlier on thin soil above hardpan, or on ill-drained soils, in support of this view.

The gentleman who gives this series of experiments to the world says farmers in Western New York have long been in the habit of looking at an orchard as something that would yield an income without care or labor, so that "for twenty years they have sown neglect and are now reaping the harvest." The entire value of fertilizers extracted from an acre in twenty years by apple trees, fruit and leaves are here stated:—

TABLE XX.

	Apples.	*Value.*
	Pounds.	
Nitrogen	664·8	$ 99 72
Phosphoric acid	51·0	3 57
Potash	971·4	43 71
Total for twenty years		$ 147 00
Total for twenty years (leaves)		160 51
Total for life of trees (wood)		70 00
Grand total		$ 377 51

The Western New York apple-grower, however, has more assistance from nature in the culture of his land than has the orchardist of Western Oregon. There the frosts of winter penetrate the soil with an aerating result almost equal to cultivation, when the winter season brings a succession of severe frosts and intermitting thaws. Very little help of that kind or from the fertilization of snow comes to the Oregon orchardist. He gets results, however, more directly and more quickly in reward for his own care and labor than the apple-grower on the Atlantic

side can. But for the reason that the apple trees bear and overbear much earlier, the demand for replenishment of fertilizing agencies is the more imperative in Oregon.

The Wagener apple tree selected as a basis of the experiments I have quoted is stated as 13 years old and 18 to 20 feet high. This was the beginning of its profitable bearing season in that climate. The writer planted a block of ground to apples in 1856 that began bearing the third year, and had exhausted the ground for apples and were on the decline within 13 years; they were one rod apart, and the roots interlaced in seven years. They had all that cultivation and barnyard manure could do for them, and they made returns bountifully. The result of trying to prolong the life of the Yellow Newtown Pippins (which were planted as standards in the block) by grubbing up all the temporary trees, convinced me that on light soils, with a hard subsoil, it is better economy to start a new orchard on fresh land than to labor to prolong the life of trees spent by early overbearing. That is the condition of hundreds of old orchards in Western Oregon today, and many of them have been in that condition for 20 years or more. I am glad to be able to say, from last year's traveling and observation, that many of their owners are waking up to this condition of things; some have already reached the conclusions above mentioned, have planted new orchards on fresh land and dug up the foul old trees and consumed them, or are doing so.

There are, however, old orchards on good soil with good natural drainage, which will pay for renovation. For owners of such, the following is written:—

As there can be no better road to success than to tell how success is attained, I will relate an instance of success in renovating an old orchard in Oregon. (Trusting that the experiment originating at the suggestion of Dr. J. R. Cardwell, and being carried out by Mr. H. E. Dosch, will not discredit it, I add the fact that I visited the orchard myself recently and saw its present condition.)

Mrs. Dosch purchased the place eight years ago in a rather forlorn hope of saving her husband's life, which physicians said would not last six months longer in his then business. There was an old orchard—prunes—12 years old, intergrown with plum sprouts and young fir trees higher than the prune trees, which were covered with moss and everything that attaches to a neglected tree. After two months of grubbing and dragging out, there was found to be 700 prune trees, 100 of which were entirely dead. Their places were filled with 100 young trees, and the heads of those having life were cut back to within a few inches of the formation of the head, leaving 600 small stumps

on the three acres. They threw out a few new shoots the first year, and encouraged by that, the trees were plowed, harrowed and fertilized with a dressing of bone meal, ashes and muriate of potash every spring. The result is, they have borne fruit now for four years past,—excellent fruit,—ranging from 8,000 to 12,000 pounds per acre, and, of course, will yet increase until the heads reach a proper balance with the roots.

The apple orchard was not much better. Forty years old! It was a wilderness of sprouts, moss, woolly aphis and everything that preys upon a neglected fruit tree. These were also renovated, pruned, fertilized and sprayed, and now they bear from six to twelve boxes of excellent fruit per tree.

This was the result of an experiment suggested by Dr. J. R. Cardwell and laughed at by Mr. Dosch at first, who did not then know, perhaps, that the words "While there is life, there is hope," applies to a tree as to a man. And though the experiment now is a success, as anyone can see, as the writer has done, Mr. Dosch is not sure whether in the long run, because the trees were not properly planted at first, it would not have been best economy to have dug the old trees up and planted anew. Had such a course been adopted, the renewal of the fertility of the soil by manures and cultivation would have been the first requirement. It is found by the best practical nurserymen that one crop of young apple trees so completely takes up the elements of fertility on the very best of soil for apples that a change to cherries, peaches or plums is always advisable, if the land must again be used as a nursery; but fresh land is always preferable.

This is the effect of three or four years' use: A crop of apple trees takes fertilizing value from the land to the amount of $5.90 per acre; pears, $4.87; peaches, $4.27; plums, $3.79. A study of these figures will indicate why my apple orchard planted one rod apart had, beginning to bear at three years old on light clay loam with iron hardpan two feet below, exhausted the soil for apple trees and apples in 15 years, in which time apples had dropped in price from $3 per bushel to being used for cider or stock feed, and mercantile fertilizers were not purchasable even if they had been thought of. It is a rising, not a falling, market which encourages and justifies investment in fertilizing where there is no fresh land to use. Of course, there is no fresh land, in the fullest sense, on any open land farm in the oldest settled portion of Oregon, but to plant trees on ground that has heretofore been used for grain or grass, eaten off by close pasturage or removed by hay, is a rotation of crops. At the same time, if the experiments I have cited be approximately correct, which I do not doubt, the planting of an orchard is the beginning of a

more depleting process than grain-raising, unless it is accompanied with the use of fertilizers.

In conclusion, I must reiterate: On well-drained, strong clay loam, a very old orchard may be renovated by thorough pruning, cultivating, fertilizing and spraying, the last as a means of insuring the crop wholesome and salable.

ORCHARD CULTIVATION.

BY PROF. THOS. J. BURRILL, PH.D., and JOSEPH C. BLAIR.

Throughout large sections of the country may be found the rotting remnants of once extensive orchards, representing large original expenditures of both labor and money. The frequency with which such localities are met would almost seem to justify the statement, usually heard in the neighborhood where such "worn out" orchards are found, that the soil is not fitted for the growing of fruit. On the other hand, the enormous apple and other fruit production in other parts of the state, and frequently in localities not far distant from those first mentioned, makes it evident that the reason so often assigned cannot be the correct one.

On examination and inquiry it will be found to be almost invariably the case that the true reason for the failure or dying out of an orchard is the lack of sufficient, or the entire absence of, proper *cultivation* and *care*. While the agriculturist has been devoting his time and attention to the care of his field and garden crops, it is too often the case that his orchard has been left to care for itself, with the above mentioned result.

The commonest cause of failure of orchards may be traced to the ill effects of summer drought. One of the worst things that can happen to trees is the failure of a sufficient supply of soil moisture, when, during midsummer, the leaves are normally sending into the air surprisingly large quantities of water obtained solely through the roots. A continuous and sufficient supply of water is essential for all the vital processes of vegetation. Apple trees severely suffer when not so supplied. They may live under otherwise favorable conditions, but they can neither properly mature a crop nor prepare for one the succeeding year without sufficient moisture.

More especially, and aside from its direct baneful effects, injury is likely to follow a summer drought in a well-known way. A scant supply of water tends to check growth, to ripen that already gained, and then to terminate in effect the season's period of development. The tree so untimely maturing its season's growth is somewhat in the condition it should be at the

close of the year. Subsequent spring-like influences cause a second development of activity, and more or less resumption of growth late in the year. The tree now goes into winter in poor condition to withstand even the ordinary vicissitudes of the season. It suffers, not so much because of severe climatic influences, as because of its own abnormal, if not enfeebled, condition. It is therefore of the utmost importance to care properly for the orchard in the summer, if we wish to avoid disaster in the winter. There is no way usually practicable by which the soil can be kept continuously moist through the summer, except by preventing the evaporation of water from its surface by a *dust mulch.* To make and keep this dust mulch, frequent shallow cultivation must be practiced. The principal object is to show the value of such cultivation in orchards by reporting results of experiments described herein, and to show the methods by which the work has been done.

In 1887-88 a series of experiments in orchard cultivation and management was begun at this station. During the first two or three years the work was not very systematic, but the general results showed that the effect of the cultivation was to conserve the soil moisture. In 1890 a portion of ground was set aside for the further and more systematic development of this experiment. Six rows of trees were planted in this subdivision of the orchard—three of Ben Davis and three of Grimes' Golden. This new plantation was then divided into five plats. The first of these was cultivated clean, the second cropped with oats, the third with corn, the fourth with clover, while the fifth and last was seeded with blue grass.

This system of cropping and cultivation has been since continued, and the results of the experiment are shown in the accompanying illustrations and tables.

Plate 1 shows a typical tree from each of the five plats. The marked inferiority of the trees from the oats and grass plats, particularly the latter, may be seen at a glance; while the superiority of the one from the clean cultivation plat, as regards vigorous and healthy appearance and wealth of foliage, is almost as equally apparent. Plate 2 and its accompanying table and plate 3 are further illustrations from the same trees that are shown in plate 1. The character of foliage and marked difference in diameter of trunk, especially between the trees, from the clean cultivation and corn plats and that grown in blue grass, is particularly well brought out in plate 3.

Plates 4 to 6, inclusive, are further illustrations of the same contrast, and show the appearance of the trees in the plats. The stunted condition of the trees in the grass plat (plate 6) as contrasted with the fine, healthy appearance of those having had

the clean cultivation (plate 4) and those in the corn plat (plate 5), is particularly striking, and should, when it is remembered that the plats are situated side by side and within a few feet or rods of each other, prove a fruitful source of reflection to the thoughtful orchardist or agriculturist.

Tables 1 and 2, following, give measurements of one row each of the two varieties in the portion of the orchard devoted to the cultivation experiment.

It will be noticed from these tables that the trunks of the trees in the corn plat average about the same or slightly larger than those in the clean cultivation plat. From this, if all the circumstances of the case were not taken into consideration, the erroneous conclusion might be drawn that cropping the orchard with corn was beneficial to the trees. The trees were planted only fifteen feet apart each way, and after the first two or three years the intervening spaces were so shaded that the corn attained a growth of something less than one half the normal size. The result would undoubtedly have been different had the trees been set farther apart, and the corn allowed opportunity to attain its full growth and development during the latter years of the experiment; and it has been shown by the experiments elsewhere that the cropping of mature orchards where the trees are set wide apart, with corn, has a deleterious effect on the trees.

TABLE I.

Row three, Ben Davis.

Tree number.	*Diameter of trunk at surface of soil.*	*Diameter of trunk 1 foot above surface of soil.*	*Height.*		*Diameter of top.*		
	Inches.	*Inches.*	*Feet.*	*Inches.*	*Feet.*	*Inches.*	
1	18½	16¼	19		16		Cultivation.
2	19¾	17½	18	6	15	4	Cultivation.
3	20	16½	19	9	15		Cultivation.
4	18½	16¾	18		15		Cultivation.
Average for plat	19 3/16	16 11/16	18	9¾	15	4	
5	16	14	18		13	6	Oats.
6	14¼	12¼	17		12		Oats.
7	18½	15½	18	6	13	10	Oats.
8	17¾	15¼	18	6	14	8	Oats.
Average for plat	16 11/16	14¼	18		13	6	
9	21	18¼	18	6	15		Corn.
10	19½	16¾	18		14		Corn.
11	22	18½	18	3	15		Corn.
12	20¾	17½	18	6	13	6	Corn.
Average for plat	20¾	17¾	18	8¾	14	4½	
13	20¾	19	19	9	15	6	Clover.
14	19	17½	17		15		Clover.
15	18½	16	17		13		Clover.
16	16¾	14¾	16	6	12		Clover.
Average for plat	18¾	16¾	17	6¾	13	10½	
17	8¾	7¾	10	6	7	6	Grass.
18	10	9¼	11	6	9		Grass.
Average for plat	9⅜	8½	11		8	3	

TABLE II.

Row six, Grimes' Golden.

Tree number.	*Diameter of trunk at surface of soil.*	*Diameter of trunk 1 foot above surface of soil.*	*Height.*		*Diameter of top.*		
	Inches.	*Inches.*	*Feet.*	*Inches.*	*Feet.*	*Inches.*	
1	9¾	8¼	13	4	8	6	Cultivation.
2	13½	12	14	9	11	9	Cultivation.
3	13¼	11¼	14	6	10		Cultivation.
4	12½	10¾	14		10		Cultivation.
Average for plat	12¼	10½	14	1¾	10	0¾	
5	11	9¾	13		8	6	Oats.
6 (dead, 1897)	6¾	6	8	6	5	4	Oats.
7	9¼	8	13		8	6	Oats.
8	9	8¼	13		8		Oats.
Average for plat	9	8	11	10½	7	7	
9	16¼	13¾	16		12		Corn.
10	15¼	13	14	6	9	6	Corn.
11	12¼	10½	13	6	10		Corn.
12	14¼	12½	15		11		Corn.
Average for plat	14½	12 7/16	14	9	10	7½	
13	12¼	10¾	14	3	9	9	Clover.
14	7½	6½	11		6	6	Clover.
15	10½	9½	12	3	9		Clover.
16	12	10¼	14	2	10	6	Clover.
Average for plat	10¼	9¼	12	11	8	11¼	
17	7½	7¼	11	6	5	6	Grass.
18	8¾	8	11		9	6	Grass.
Average for plat	8⅛	7⅝	11	3	7	6	

TABLE III.

Measurements of specimens in plate No. 2.

Number.	*Butt.*	*Middle.*	*Crotch.*	*Plat.*
	Inches.	*Inches.*	*Inches.*	
1	18	16½	16¼	Cultivation.
2	14⅝	13½	13⅜	Oats.
3	18½	17	16¾	Corn.
4	17¼	15½	15¼	Clover.
5	10½	9¾	9½	Grass.

The effect of cultivation on the root system of the trees is shown by the following measurements of the main roots of each of the trees shown in plates 1, 2 and 3:—

Cultivation plat.—Root eight feet six and one half inches long. At three feet six inches away from the trunk it started down. It went down until it reached a point five feet below the surface, when it ran horizontally. Ends rather stiff and blunt. No fine fibers at the end. Two feet from the trunk it measured one and three fourths inches in circumference. Numerous fibers in the soil were cut in digging.

Oats plat.—Root fourteen feet four inches long. Nine feet away from the trunk it was only fifteen inches down. It then turned downward, the end being three feet eight inches below the surface. But few small rootlets. Two feet away from the trunk the root was four inches in circumference. Roots were long and whiplike, with little tendency to branch out.

Corn plat.—Root fifteen feet eight inches long. Eleven feet away from the trunk it divided up into four branches, two of which started down, the third turned laterally and the fourth appeared to be a continuation of the main root. The latter is included in the total length. One branch started down and reached four feet four inches below the surface. The root had a great number of small roots along its length, with many smaller branches. The main root two feet from the stump was four and three fourths inches in circumference and each of the four branches was almost one inch in circumference.

Clover plat.—Root eight feet four inches long. Three feet six inches away from the trunk it turned down. It was then one foot down below the surface. It ran straight down four feet six inches more. At two feet away from the stump the root was four inches in circumference. The root had but few branches and almost no fibers when compared with other plats.

Grass plat.—Root ten feet eight inches long. Ran out horizontally. The end was eighteen inches below the surface. One branch started at fifteen inches away from the trunk and ran down four feet nine inches. Two feet away it was one and three fourths inches in circumference. Root small. Horizontal root much branched near the end.

Here the superiority of the clean cultivation is at once apparent. The root system is compact, and instead of lying near the surface of the ground where it is easily reached by drought and meteorological disturbances, it strikes deep into the soil. This is the direct effect of the conservation of moisture in the subsoil by the protecting mulch formed at the surface by the cultivation and tillage. These have so fitted and prepared the soil that the plant is enabled to get its food at home, while the moisture that

has been kept from evaporation by pulverizing the surface soil has enabled the roots to strike deep, thus giving the plant a firm and compact basis. This is well contrasted with the oats and grass plats, where the roots grew shallow and ranged wide from the tree.

The deep cultivation in the clean plat also kept the roots from spreading near the surface by keeping them pruned there until they were forced to strike deep. The corn plat, on the other hand, was never cultivated over three inches deep. The roots of the trees were not obliged to strike deep for their nourishment so as to use what was in the ground nearest them, but spread widely just below the range of cultivation. This would lead to the conclusion that the growth of the trees in this plat was due in some measure to the peculiar fitness of the land for the purpose, rather than to anything inherent in the shallow cultivation.

As the object of prime importance in the cultivation of the orchard is the conservation of the moisture which is essential to the growth of the trees and the fitting of the trees to utilize all the food in their immediate vicinity, it follows that no crops which have a tendency to deplete these stores of moisture and food should ever be allowed in the orchard. Under no circumstances should hay or any grain crop be grown on orchard land. In the orchard of Mr. H. A. Aldrich may be seen an example of this, if anything further in that line be needed. In that orchard is a plat of trees, all planted at the same time, one half of which has been permanently set back by a single year's cropping with oats.

Corn or any other hoed crop may be used in the orchard during its first two or three years, but it is inadvisable to continue cropping of any description for a much longer period — certainly not after the trees have arrived at a bearing age. Nothing should be taken from the orchard after that time but the fruit. Occasionally an orchard may be seeded and allowed to go for a year or two in sod, but no hay should ever be cut, and usually as the strength of sod increases the amount of foliage and fruit will decrease. If the soil is lacking in organic matter, an occasional crop of clover or cow peas may help the orchard, but this should be plowed under at the end of the season and not removed from the ground.

Two illustrations may be given to show the actual effect of cultivation in the preservation of soil moisture. The fall of 1897 was an exceedingly dry one. Careful analyses made of soil samples from the plats devoted to the cultivation experiment during October, 1897, showed for the first twenty-seven inches an average percentage of moisture for the various plats approximately as follows: —

Clean cultivated	12 per cent.
Corn	12 per cent.
Clover	10 per cent.
Oats	8 per cent.
Grass	8 per cent.

When it is borne in mind that the amount of moisture must exceed ten per cent. to make it available to the plant to any extent, the superiority of the clean cultivated and corn plats (the latter of which was, as has been said, practically clean cultivated also), so far as the amount of moisture is concerned, is apparent.

The other illustration is that of the main orchard at the experiment station, which is shown in plate 12. During the entire season of 1897 it was kept in a good state of tilth and in spite of the extreme drought held its wealth of foliage during all the dry weather and bore an abundant crop of fruit.

PREPARATION OF THE SOIL FOR PLANTING ORCHARD TREES.

If the land is not naturally well drained it should by all means be tile drained, particularly if it has a stiff and rather impervious subsoil. This is of greater importance even than subsoiling, as the results of the latter can only remain for two or three years at the outside. Subsoiling may start the root system down properly, but if the subsoil is of the kind above mentioned it will in time relapse into a state of impenetrability if not underdrained.

Ordinarily all orchard land should be thoroughly gone over with a subsoil plow before trees are set — always so, if there is a hard subsoil within two feet of the surface. On some light prairie soils, where the hard subsoil is much lower than this, then subsoiling is superfluous.

It should always be borne in mind that the care the orchard gets during its first six or eight years largely determines its ultimate fate, and that the directions before given in regard to the care and cropping of the young orchard are doubly important when viewed in relation to its subsequent life.

To give final emphasis to the foregoing remarks, reference is made to the accompanying illustrations (plates 11, 12 and 13). Plates 11 and 13 show an orchard in which systematic cultivation has not been carried on. Plate 12 is a view in the main orchard of the experiment station. It was taken in September, 1897, at a time when a large majority of the apple orchards throughout the state were almost completely defoliated as a combined result of drought and apple scab. The tree in the foreground, with its wealth of foliage and bending under the weight of its load of fruit, tells its own story, and stands forth in marked contrast to the preceding picture. From it there can be but one

PLATE 1.

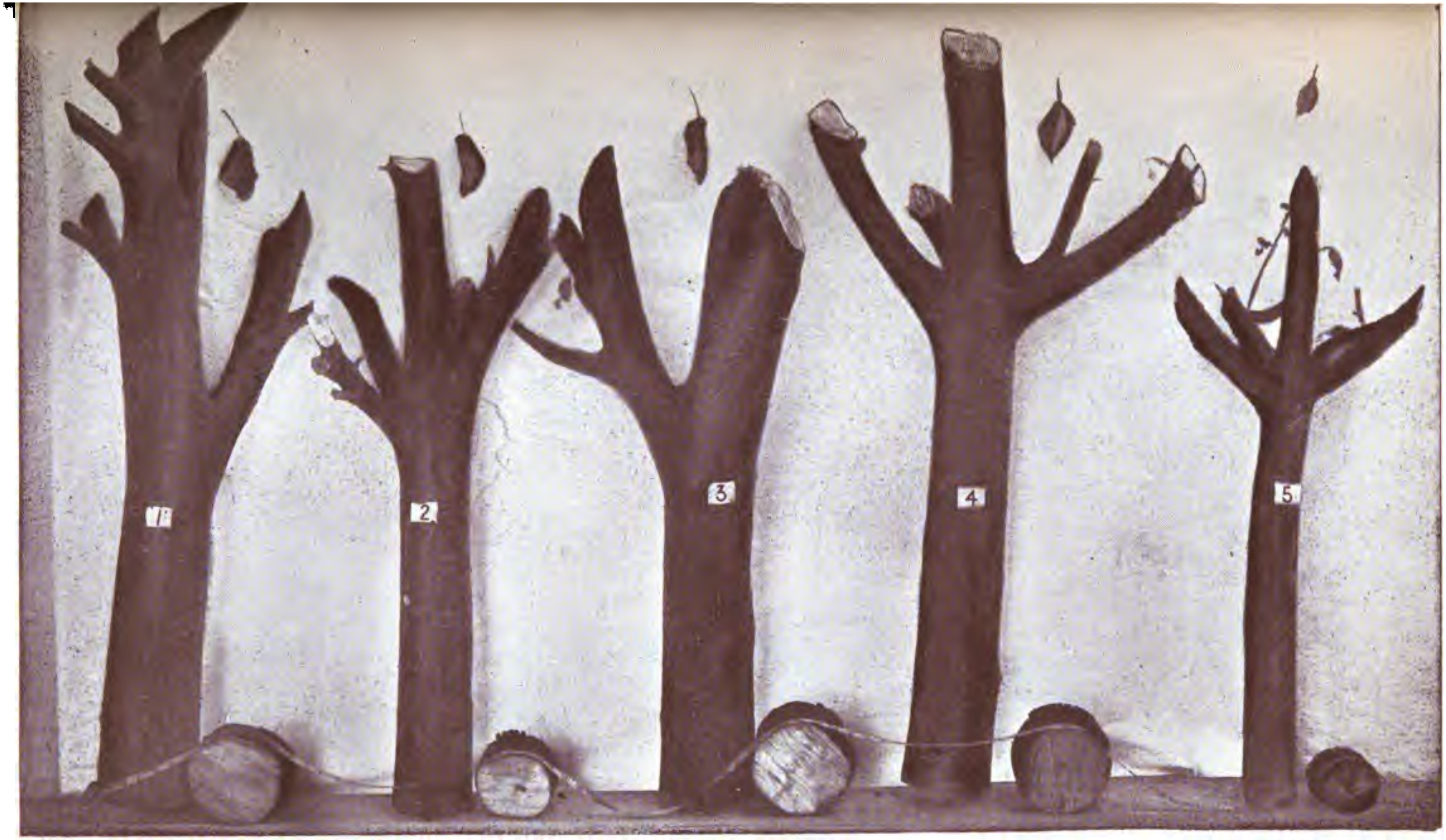


PLATE 2.—TRUNKS AND CROSS SECTIONS OF THE FIVE TREES SHOWN IN PLATE 1.

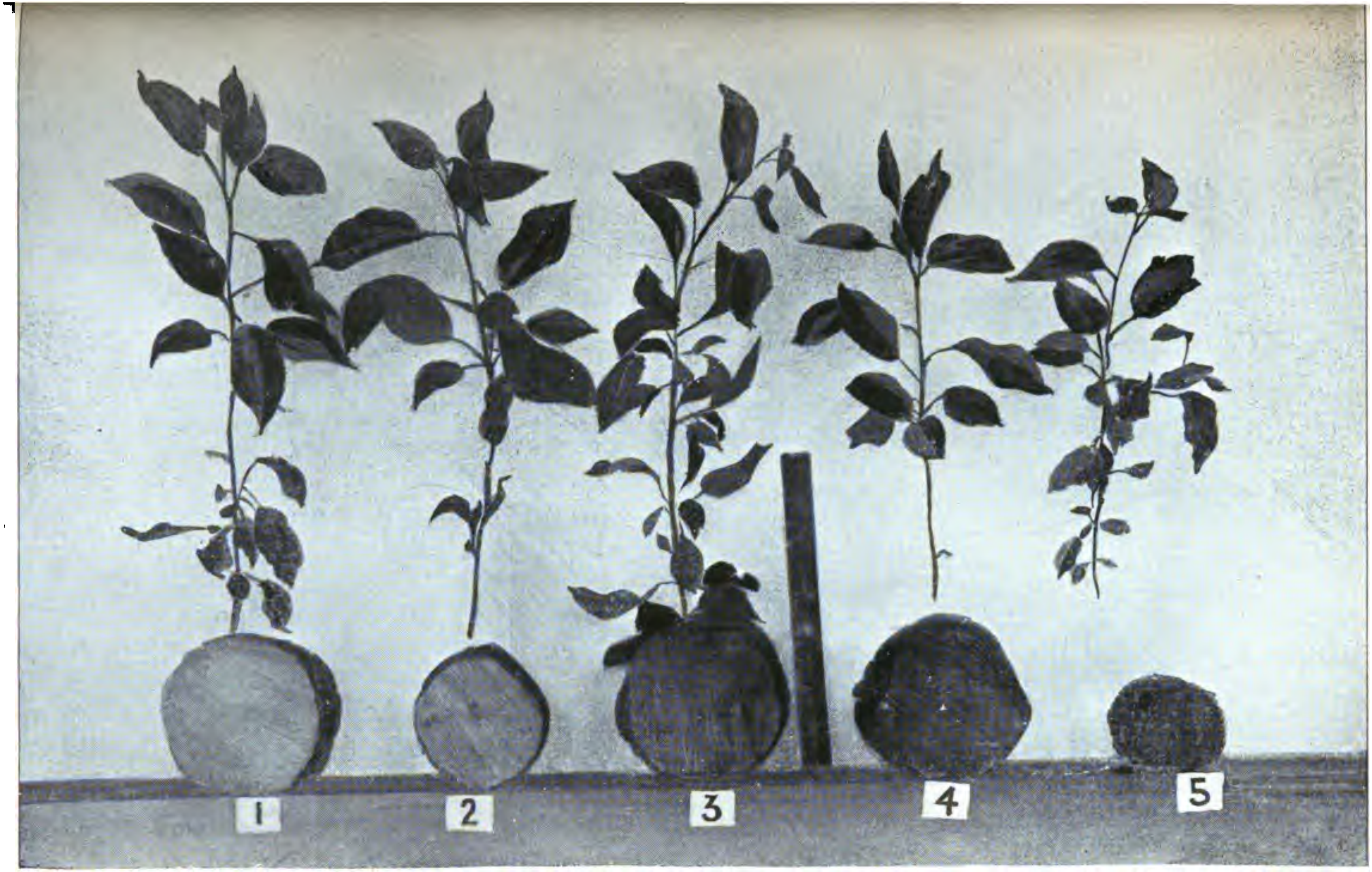


PLATE NO. 3.

OATS PLAT. PLATE 4. CLEAN CULTIVATION.

CORN PLAT. PLATE 5. OATS PLAT.

BLUE GRASS PLAT. PLATE 6. CLOVER PLAT.

PLATE 11.—AN UNCULTIVATED YOUNG ORCHARD.

PLATE 12.—A CULTIVATED ORCHARD.

PLATE 13.—AN UNCULTIVATE AND OTHERWISE NEGLECTED OLD ORCHARD.

conclusion drawn—that while other things have greater or less effect upon an orchard's health and condition, the prime requisite to successful orcharding is through and systematic cultivation.

THOMAS J. BURRILL, PH.D.,
Horticulturist and botanist.

JOSEPH C. BLAIR,
Assistant horticulturist.

DESCRIPTION OF PLATES.

Plate 1. A typical tree from each of the five plats.
No. 1. Tree from cultivated plat.
No. 2. Tree from oats plat.
No. 3. Tree from corn plat.
No. 4. Tree from clover plat.
No. 5. Tree from blue grass plat.

Plate 2. Trunks and cross section of the five trees shown in plate 1.

Plate 3. Cross section of trunks and one year's growth of twigs with their foliage of the five trees shown in plate 1.

Plate 4. View of a portion of the oats and clean cultivation plat.

Plate 5. View of a portion of the corn and oats plat.

Plate 6. View of a portion of the clover and blue grass plats.

Plate 11. An uncultivated young orchard.

Plate 12. A cultivated orchard as seen on the experiment station grounds, Dominie apple tree in the foreground.

Plate 13. An uncultivated and otherwise neglected old orchard as seen on an Illinois farm.

OREGON FRUIT DISTRICTS.

By HENRY E. DOSCH.

"Who plants a tree knows not, nor thinks for whom
That tree may bloom;
But some one coming after him will bless
His thoughtfulness."

It has been said that Oregon, the state of plenty, is nothing, if not an horticultural state. All fruits, including the tender olive, do exceedingly well here. In Oregon the planter cannot only find the localities best suited to the different varieties of fruits, but, in addition, has his choice as to climate. He may select Eastern Oregon with its extreme seasons; Southern Oregon tempts him with its enchanting valleys, clear skies and balmy air. Then there is our own Willamette valley of two hundred miles or more in length, with its equable climate throughout the year; or, if fond of sea breezes, the various valleys along our coast line. As between bottom lands and hillsides, the latter are preferred. Oregon, therefore, offers an inviting field for the orchardist.

The arid lands of the vast inland empire, located east of the Cascade range of mountains, and especially along the canons and flat areas of the Snake river, which were heretofore considered only fit to grow sagebrush and greasewood, and the home of the jackrabbit and toads, has proved wonderfully fertile under irrigation and under the management of progressive, up-to-date farmers and fruit-growers. Canals have been dug, varying in length from twelve to thirty miles, covering thousands of acres of these lands which are now being brought into cultivation. It was my privilege to spend a week with some friends near Ontario, along the Snake river, last August, and to see the transformation of a desert into an oasis. Hundreds of acres had been sown to alfalfa with surprising success. On the K. S. and D. ranch they were harvesting the third cutting and flooding the lands for the fourth crop, the average yield being seven tons of hay per acre for the season. On this same ranch is an orchard covering two hundred acres planted to peaches, apples, pears and prunes, being then two, three and four years old, in a most perfect con-

dition, both as to health, vigor and luxuriance of foliage, with the thermometor at 130° Fahrenheit in the sun. It is almost beyond belief what water, under the control of intelligent endeavor, will produce on these soils. This alfalfa is fed to hogs, calves and steers for the markets, thus bringing a ready cash revenue to meet expenses, while the orchard is slowly but surely growing into a revenue-producing fact. Along these benches is room for thousands of happy, contented homes, amid plenty to eat and drink, and pure, invigorating health-giving air to breathe. I never tasted finer peaches and watermelons than right there. Many of the grapes then forming measured ten inches in length to the bunch, with berries as large as marbles; in fact, the bunch of grapes which won the medal at the world's Columbian exposition at Chicago, was grown near the Snake river.

The beautiful Grand Ronde, Wallowa, Burnt river, Powder river, Eagle creek and numerous smaller valleys scattered throughout these higher plateaus and Blue mountains, as well as Hood river valley, along the Columbia river, and which do not depend on irrigation, are most fertile spots for the fruit-grower, especially the rolling foothills. Perhaps nowhere do apples, pears, cherries and prunes grow to greater perfection, as to size, flavor and color than in these valleys. A paper was recently read at a farmers' institute, held at La Grande, in which the writer said: "At Cove (the garden spot of the Grand Ronde valley), and here at La Grande, instances have been reported and verified where over $500 have been received for the product of a single acre of Jacunda strawberries, while there is no place under the sun where red raspberries do better than here." He considers the apple, pear and cherry the most profitable fruits for that locality. The fruits grown there, on account of the high elevation and climatic influences, have peculiar keeping qualities; the cherries, owing to absence of rain, do not crack open, and by reason of so much sunshine color highly, come into market late and consequently always bring remunerative prices.

Southern Oregon, with its decomposed granite soils, as found in the Rogue river and Umqua valleys, offers the same advantages for horticulture, and at no distant day will be a veritable paradise for the fruit-grower. Its soils are naturally very rich in all the plant foods necessary to produce excellent fruits, combined with a climate unsurpassed anywhere in this fair land of ours. The vast mining districts of this section, which are fast assuming large proportions, will furnish a very good local market for the small grower, while most commercial growers prefer to ship their products to the east, England and Germany, where these fruits have found a very profitable market. Peaches, apples, pears, prunes, French walnuts, almonds, grapes, all kinds of

berries and water and muskmelons grow in great abundance. It is surprising that the growing of wine grapes has not been followed extensively. The Rogue river valley, which is, in respect to soil and climate, like the famous Burgundy valley of France, is the place par excellence for the growing of this variety of grapes. There is no good reason why the hillsides of that productive valley should not be covered with vineyards. Grapes of as good quality as those grown in California or in France can be produced in that valley.

Our own beautiful Willamette valley does, and always did, grow fine fruits. True, they have not the keeping qualities, owing to our humid climate, as those raised in the more dry localities and higher altitudes, but for size, color and flavor are not excelled anywhere, besides having the advantage of nearness to the large local markets of our cities, as well as cheaper railroad and ocean transportation to the markets of the world. Here flourish the apple, pear, prune, cherry, peach, apricot—all the smaller fruits in great abundance, and grapes galore. That grapes do well in Oregon is evidenced by the fact that there are small vineyards in every part of the state, but I know of only one commercial vineyard in Oregon, which is located on the red hills back of Forest Grove, in Washington county; here is a vineyard of eighty-four acres. Every year these vines are weighed down with large bunches of the choicest grapes, each vine or stalk yielding from 50 to 100 pounds. These sell for $25 a ton. When the owners of these vineyards came to Oregon, not many years ago, they were in moderate circumstances. They had to clear the land and plant it to grapes, and are now well-to-do. I have been in the famous vineyards of Germany, France and California, but have never seen such an abundance of grapes as these Forest Grove vines bear from year to year, nor have I ever tasted grapes of finer quality. The principal varieties grown are Moore's Diamond, Niagara, Sweetwater, Delaware and Hamburg, and such wine grapes as the Riesling, Gut-Edel, Muscat, Burgundy and Zinfandel.

In this connection permit me to state that at the trans-Mississippi and international exposition, held at Omaha last year, we had four kinds of wines on exhibition, prepared by A. Rueter, of Forest Grove, one of the owners of the vineyards mentioned above. These wines came into direct competition with similar brands from California, namely, Riesling, Muscat, Zinfandel and Burgundy. Much to my surprise, the jury awarded us the highest medal and diploma for excellence, fineness, aroma or bouquet, as it is generally called, smoothness and for the absence of that pungent and alcoholic taste so pronounced in California wines, notably in Zinfandel. I said it was a surprise to me, and

yet it should not have been, for I know that our soil and climatic conditions, especially of the foothills on both sides of the Willamette valley are identical to those of that part of the Rhine, in Germany, where the finest of wines are made. I immediately investigated further and from the growers I learned that it is owing to our humidity and cool nights, which makes the skin thinner and has a general tendency to produce the good effects spoken of above. The next point which presented itself to my mind was its keeping qualities and its improvement or deterioration with age, knowing that one of the best points of Rhine wines is its improvement with age. Hence, I called upon several of our wine merchants, who are thoroughly conversant with the wines of both Europe and America, and they tell me that our Northwestern Oregon wines are like the Rhine wines in this respect, the older they get the better they are and finer the bouquet, while California wines will sour or turn into vinegar in six years, as is the case with the wines of Southern France, unless kept in very deep, cool cellars and handled most carefully.

The beautiful and fertile little valleys along our coast line are all adapted, more or less, for fruit-growing. This has been proven by Mr. T. S. Malehorn, of Langlois, Curry county, a most progressive orchardist, who has not alone succeeded in growing nearly all the varieties of fruit grown elsewhere in the state, but has now fruiting acres of the tender olive. A little enterprise and energy will accomplish wonders in horticulture and viticulture in Oregon.

However, there is one fruit which does not receive that attention it deserves, and that is the growing of nut-bearing trees. We now import into Oregon between $300,000 and $400,000 worth of nuts, and the demand is increasing. I have been advocating the planting of nut-bearing trees, more particularly the French walnut, for many years, and have received some letters of inquiry regarding nut culture, and know that some trees have been planted, in an experimental way, which have done exceedingly well.

Horticulture is no longer an experiment in Oregon. The incessant drudgery, the numerous and keen disappointments which are peculiar to all new enterprises, and from which horticulture in Oregon did not escape, are things of the past. We have reached the era of scientific management of the orchard and of remunerative prices for the product. Fruit-growing is as profitable as any of the several branches of agriculture; in fact, it has been proven year after year that those who have fruit to sell, whether it was raised alone or in connection with other crops, always have money to meet their obligations. The commercial agencies report that there are fewer failures among those engaged

in horticulture than there are in any other branch of agriculture.

Though fruit has been grown in Oregon for over forty years, it is only recently that horticulture was reduced to a scientific basis. The backwardness which was the ruling condition until a short time ago, was due to lack of knowledge about tree-planting and fruit-growing. Very few growers were thoroughly equipped for the business in which they had invested their capital. The state took horticulture in hand, and now supplies an abundance of information to all who care to ask for it. This information is distributed through members of the board of horticulture and the faculty of the Corvallis agricultural college. There now exists no reason for failure, because of the absence of useful information about soils, stock selection, tree planting, cultivation, pruning and the science of pollination. That the growers have profited by the work done in their behalf by the state, and that there has been a vast improvement over former methods is abundantly proven by the touching up given to old orchards, and the strong, healthy look of trees which are now growing into bearing. Progressive horticulture does wonders. It makes the old trees bear fruit again and gives the young ones a good start from the time they are set out. Failure and discouragement in horticulture often result from too much real estate booming. Glowing accounts of this or that locality are published, fruits of abnormal size are exhibited, ridiculous results are given, all of which creates the impression that horticulture, in certain localities, is a veritable Klondike. Credulous persons, tempted by these stories and exhibits, give up occupations in which they are experienced and take to fruit-raising, of which they know nothing. With them failure is only a matter of time, unless they have an abundance of money. Horticulture is a special work, an applied science. In it expectations are never realized without pains-taking work and trying patience. No one should think of going into it when the main inducement is an enormous profit figured on paper. There are growers in Oregon who have made large profits in a single year. In some years all have done exceedingly well; but, generally speaking, it is not safe to count on a net profit of more than $100 per acre in ordinary years for an orchard in full bearing. This result, small as it may seem to the uninitiated, will come only to those who go into the business understandingly, give to it their best thoughts and care, manage the fruit farm as they would any other business venture, and keep abreast of the times. The failure of those who had no adequate knowledge of fruit-growing, and who under the same circumstances would have failed in any other enterprise, need not discourage any who intend to embark in horticulture. The number who have failed is very small in comparison to the number who have succeeded.

No state offers such excellent advantages as Oregon does. There need be no fear of overproduction. The consumption of fruit increases every year, and there is ready sale for all first-class goods put on the market.

While waiting for his orchard to bear, which usually takes from five to eight years, the orchardist has an avenue of profit opened to him in the growing and marketing of small fruits. The demand for strawberries, currants, gooseberries, raspberries and blackberries for home consumption and for export is very large and is seldom met by the supply. Many carloads of these fruits, especially strawberries, are shipped every year to the mining and stock-raising districts of Idaho, Montana, North Dakota and South Dakota. Shipments of these berries are often made to St. Paul and Omaha; yes, even to Chicago, yielding most gratifying results. If the small fruits are given proper care and sent to the market in good condition, they bring in sufficient money to meet the family expenses. Even after the orchard begins to bear there is nothing to prevent the orchardist from having two crops—berries in the spring and early summer and tree fruit in the fall, thus dividing the labor and at the same time doubling the profit. In some parts of the state orchardists plant beans between the rows of young trees. This crop yields a net profit of about $30 per acre.

Horticulture on a large scale offers exceptionally fine opportunities. An orchard conducted on this plan is termed a commercial orchard. As yet there are few orchards in Oregon where fruit is grown for shipment in carload lots. There are two of apples exclusively, one having 10,000 trees and the other 15,000 trees; one of pears, having 12,000 trees; two of apples and pears mixed, and a few prune orchards, having between 10,000 and 20,000 trees. Most of our prune orchards contain five to twenty acres. They are to be found in all parts of the state. The two large apple orchards referred to are not yet in bearing, being now five years old. The trees in the other orchards are from six to eight years old and have borne several crops, which were marketed at very good prices in the east. The fruit of one of the pear orchards sold for eighty-seven and one half cents per box, f. o. b. at Salem, and that of the other for $2.40 per box in New York and Boston. While the owners of these large orchards were highly successful in the growing and marketing of their crops, the policy of confining one's self to one or two varietes of fruit is open to question, and as there are off years in horticulture, in one or the other fruits, as well as in other lines of business, it is prudent therefore to plant a variety, so that if one kind fails the other will make up the loss. The planting should be in alternate rows for pollination purposes. For exam-

ple, in setting out apples, plant first a row of, say, Wolf River, next a row of Spitzenberg, then a row of Ben Davis or Jonathan or Gravenstein or Gano, just such varieties as one desires to plant; in pears, one row of Bartletts, then one row of Beurre Clairgeau, then one of Fall Butter, then one of Beurre d'Anjou, and then repeat. The same method should be followed in planting other kinds. It is always best to avoid mixing the different varieties. Apples should be planted in one block, pears in another, prunes in another, and so on.

A writer said that "most farmers who have been raised on a farm know how to do good farming. They know how to save and apply manure; how to mellow the stubborn soil with plow, harrow and cultivator; know the value of good seed, the proper time to sow and the quantity required. They understand the necessary drainage, the rotation of crops and green manuring. Most farmers know how to do good farming, *but they do not farm so well as they know how.* Why don't they farm so well as they know how? They lack the proper pride. They have too little ambition." What has been said here of farming in general applies with equal force to horticulture. Ambition is the vital force which prompts great deeds and moves the world. How to excite this enthusiasm and put this power into action is a question to be considered and solved by the progressive orchardist. In these days of push and advancement one of the principal essentials to success is the ability to do the right thing at the right time. This ability is absolutely necessary for the success of everyone. It manifests itself in the individual by keen perception, sound judgment, practical knowledge of business and a determination to profit by every opportunity that presents itself.

That our fruit is equal to that grown in any other part of the world is evidenced by the fact that at the world's Columbian exposition at Chicago we carried off all 13 of the diplomas and medals awarded in the horticultural department. We won the prizes for apples, pears, peaches, cherries and prunes in their fresh, as well as in their evaporated state; for grapes, the largest bunch weighing eight and three fourths pounds, and even for French walnuts. Col. E. F. Babcock, a life member of the American pomological society, president of the Arkansas state horticultural society, and a nurseryman and fruit-grower of many years experience in Western New York and Arkansas, was pomaceous judge at the exposition. So deeply was he impressed with the superior quality of the fruits of Oregon that he determined to visit the country which produced such fruit. Upon his arrival in Portland in December, 1893, he was interviewed by the editor of the Rural Northwest, and his statement was read and approved by him before its publication. In that interview he said:

"It goes without saying that the display of fruits at the Columbian exposition was by far the largest and most comprehensive of any heretofore made at any time or place. * * * In this grand display Oregon occupied a leading position. The fruits shown were very large and fine, beautifully colored and free from insect pests. * * * It is safe to say that no exhibit attracted so much attention in the horticultural department or was so highly commended."

Mr. Sylvester Johnson, who was for 11 years president of the Indiana state horticultural society, and judge of agricultural implements at the Columbian exposition, said, at the meeting of the Indiana horticultural society held at Indianapolis, when Oregon fruits were under discussion and highly praised, that he wished to emphasize what had been said about Oregon fruits. He added: "I regard Oregon as preëminently the fruit state of the union, and its fruits were better than those of California. This exhibit forever dispelled the opinion that California possesses superior advantages for fruit-growing to that of every other region of the Pacific slope. The Oregon exhibit of apples, pears and plums was not only unequalled, but it excelled that of every other state. The fact may be noted that the largest apple, the largest pear and the largest cherries exhibited at the Columbian exposition were grown in Oregon."

And again at the trans-Mississippi and international exposition, held at Omaha the past year, the jury in the horticultural building, of which Prof. H. E. Van Deman, the chief of the pomological division, department of agriculture at Washington, D. C., was chairman, awarded us five gold medals, 11 silver medals, 16 bronze medals and 23 diplomas of honorable mention, 49 medals and diplomas in all.

While it is conceded that all the various fruits can be grown in Oregon, the highest success can only be obtained by the intelligent, painstaking orchardist. The man who thinks that all that is necessary, even in this favored state, is to scratch the ground, throw in his trees in a haphazard way, with an occasional plowing or harrowing, and let it go at that, will soon find himself very much deceived.

I am firmly of the opinion, that with our new acquisitions in the orient, the markets of Japan and China now being opened to us, and that as soon as the Nicaragua canal is finished, in the construction and completion of which we here in Oregon are particularly interested, it will bring about great results for the Oregon farmer and fruit-grower. Meats have been transported in cold-storage steamers, through all climes and to every land, and so will be our fresh fruits. Tramp steamers, which are now traversing our seas in every direction, seeking cargoes from any-

where to anywhere, will crowd our docks, eager to carry our surplus fresh fruits to the markets of the world and competition will make freights low enough to allow a good margin to the grower.

To illustrate: A carload of wheat from Portland to New Orleans at present costs 45 cents per bushel, while with the Nicaragua canal finished the freight ought not to, and most probably would not, exceed 12 to 15 cents per bushel, including canal charges, etc. A carload of evaporated prunes to New York costs 1 cent per pound or $200; to New Orleans it costs 1¼ cents per pound or $250. A carload of fresh apples or pears in refrigerators to New York costs $450 and to New Orleans $550, for 20,000 pounds, while in cold-storage steamers through this canal it would cost $200 and $180, respectively, for the same quantity, taking as a guide prevailing freight rates in cold-storage steamers to other points of equal distance. On evaporated fruits the freight would not exceed 40 cents per one hundred pounds, or $80 for 20,000 pounds, as against $200 and $250 for the same quantity by rail. It requires no microscope or mathematical calculator to see the margin for the producer; nor is this all; the greatest benefit comes to the small grower who cannot ship in carload lots, and must sell at home in an open market for whatever may be offered him. Upon completion of this canal the freight per pound on 10 or 50-case lots will be the same on the steamers as on 500 or 5,000-case lots. There will be fifty buyers in our home market where there is one now, and if the prices offered do not suit, he can look up his own market and ship direct to small dealers, knowing that in the matter of freight he is on an equal footing with everybody else.

The benefits to be derived from this national work by the fruitgrowers of Oregon can only be surmised at this time; but when we consider the reduction of freights to the eastern and southern states, and the South American countries, and the possibility of shipping on board steamers in cold storage our fresh fruits to these markets and Europe, we cannot help speculating as to the ultimate result.

Those having orchards, or who are now planting, or contemplate planting, will certainly be largely benefited when this great canal, this missing link, this national maritime highway, which is an imperative necessity for the Pacific northwest, opening to the Mexican gulf, to the entire Mississippi valley and the states of the Atlantic seaboard, not only the reciprocal interchange among ourselves, but the whole commercial world, shall be completed, the practicability of which is conceded by all who have given the question any thought.

All that contributes to the gen eral welfare and happiness of the citizen, strengthens the bulwarks of our enduring nationality,

and there is no work more direct or more able of this consummation of prosperity and happiness for all, and the Pacific northwest in particular, than the construction of this commercial link, the American Nicaragua canal. So let us hope that, at no distant day, this may be an accomplished fact, with our flag floating at either entrance, waving peace and welcome to the commerce of the world, that our grain and fruit-laden ships may enter, and the American eagle hover over every ship, no matter what flag she may fly, with his wings spread out, reaching from shore to shore, giving her safe guidance and protection until she again reaches the high seas.

I love thy rivers, deep and wide,
That slowly to the ocean glide
And mingle with Pacific's tide,
Oregon, dear Oregon !

I love thy hills of deepest green,
And flowery vales that lie between
Thy wheat fields with their golden sheen,
Oregon, fair Oregon !

I love thy valleys, broad and fair,
With orchards planted everywhere,
And fruit whose fragrance fill the air,
Oregon, sweet Oregon !

I love the mists that slowly rise
And veil the blue of morning skies;
I love thy sunsets' brilliant dyes,
Oregon, bright Oregon !

I love thy giant, towering trees,
That scarcely bend to strongest breeze ;
Thy shrubs, the sense of beauty please,
Oregon, mild Oregon !

I love thy sombre, lofty pines ;
Thy tender, green, luxuriant vines,
That round each rugged trunk entwines,
Oregon, wild Oregon !

Thy verdant plains by rivers' brim,
With scattered young trees, straight and slim,
Thy purple mountains soft and dim,
Oregon, sweet Oregon !

I love, I love, Oh ! best of all
Thy distant mountains' giant wall,
With snow peaks, towering over all,
Oregon, grand Oregon !

For many centuries they've stood,
Through ages long, of storm and flood,
They've watched this country, fair and good,
Oregon, my Oregon !

BREEDING OF FRUITS.

By C. E. Hoskins.

Few nurserymen and horticulturists are aware of the amount of damage they are doing the future grower by neglecting the breeding and selecting of scions, cuttings, roots, etc., with the view of improving fruits. Nearly all our fruits are chance seedlings or accidents. The parents are seldom known, and because of their size, color, etc., are often tested in other countries and climates with the hope of getting something better than we already have, which generally proves a failure. This article on breeding of fruits is written with the hope that it may awaken a new field of thought and practice. It is the writer's opinion if we had only a few nurserymen and fruit-growers in this state intelligently breeding all the varieties that do well here we would soon have much larger and finer of all varieties than are now being grown. The assertion that future noted fruits must be a native of this state is true. Why? Because our climate, soil, etc., are peculiar, and for a fruit to do the best it must be adapted to the condition surrounding it. Thus the apple, King of Tompkins County, does nowhere so well as in New York, where it is said the old tree bears finer fruit than is found anywhere else. It is generally conceded by all that the root on which the tree is grafted has an influence over the quality of the fruit. Thus, by incessant cutting and grafting on a degenerate root, we are each time lessening the quality of the fruit, also destroying the health of the tree.

For the encouragement of the fruit-breeder a few simple directions may be given. In the first place the operator should be young. It takes years to learn the inherited tendencies of an individual tree or plant. It would be better to experiment with only one variety. He should have his ideal in mind. If the apple, it must be large, red, tough skin, good flavor, keeper, good shipper, healthy tree, and good pollen bearer, etc. Select a bearing tree or trees coming nearest his ideal. Each spring select a part of limb just before the blossoms open, prepare two wheels of pasteboard about eight inches in diameter, with a hole in the center the size of the limb, with a slit that may be laced up after being placed on the limb, cover over all with fine wire

cloth or mosquito netting, the object being to keep all insects from the blossom. After the flowers have opened and pollen formed, take off the covering and with a fine camel's-hair brush carefully go over all the blossoms, taking the pollen from another, and placing it upon the pistil, and cover as before. This work should be done every day at nearly ten a. m. or three p. m. when the weather is fair. If more than one tree is used a separate brush should be used. After the time of pollenization is passed, all the covering should be taken away, carefully marked and numbered with notes, etc. When fruit is ripe the seeds should be grown as other seedlings. When one year old they should be grafted on the tree on which the pollenizing was done, if expected to be used for breeding purposes after the fruit is seen. The roots may be left to sprout and form trees which should be carefully numbered to correspond with tops grafted, and planted in orchard form, and when bearing be used as stock to graft future inbred seedlings. The word inbred is used because they are strictly such. Hybridizing and grafting both tend to destroy the character or fixed type of the offspring, hence the necessity to graft back on original stock that the blood or breed may as soon become fixed as possible. Mr. Burbank, of California, is a hybridizer or mixer of bloods not always of the same family. Grafting is another and slower way of accomplishing the same ends. After years of grafting the stability to come true from seed has been destroyed. Potency of pollen of original blood and lack of the same in long cultivated kinds caused by reasons mentioned. The quantity and potency of pollen should be the greatest requirements in the parents.

In conclusion, must say, I find the field of breeding the most interesting in horticulture, with always something to learn. I am sure fruits may be bred and with as sure results as animals or birds. Why not breed fruits?

OREGON FRUITS—WILD AND CULTIVATED.

By Dr. J. R. Cardwell.

Inspiration and tradition tell us that man was created a horticulturist, and that in his best estate he was surrounded by the choicest fruits and flowers of nature, and that now, in his better self and ideal of life, he returns to the ancient shrine and in poetic imagery dwells in the elysian fields of Pomona, prophetic of something higher and better attainable in the future.

Fruit-culture is the most facinating, ennobling, as well as the most profitable branch of horticulture, and the advance in the fruit product is evidence of the culture and civilization of a people. It is hard to overestimate the beneficial influence on health, morals and manners of a generous fruit supply. The ornamental grounds and orchards of the homestead do much in childhood to strengthen that love of home and pride of family which is the foundation of all patriotism. The cherished memories of home thus enriched are, in after life, the strongest bond of family to bring back the absent and wandering to the roof tree; and the erring one is not wholly lost so long as these sacred memories of home and childhood sometimes come to swell the heart and dim the eye with the tear of repentance and contrition.

The fruit industry as a business in its variety, extent and commercial importance, as we find it today, is of recent origin and within the memory of the present generation, a worthy tribute to the brain and muscle of men of our time. National and international communication by water, land and telegraph, railroads, cheap freight rates, rapid transit in fruit and refrigerator cars, created the supply; inversely the supply increased the demand; an inexorable law of trade. The future commercial possibilities of the fruit trade are full of promise, and in the light of the increase of the last few years justify the most sanguine speculations. Shipping green fruit, canning and evaporating, are discoveries of today and yet in their infancy. These processes will be improved upon, extended and cheapened, and other improved methods of packing, preserving and transporting will be discovered, as popular taste is cultivated. The new glazed fruit industry is capable of indefinite extension; fruit as a confection

to eat out of hand is a new and growing industry. The manufacture of fruit butters, marmalades, jams and jellies, not to speak of fruit cider, vinegars, brandies, wines and spirits are undeveloped business schemes of great promise. Brain and muscle are at work in these lines and will succeed.

A distinguished and successful fruit-grower of California was requested to furnish a paper on "The Fruit Industry" for publication in the transactions of the California agricultural society. The response — brief, comprehensive, in the following well-chosen words—applies so well to Oregon that I am inclined to quote and close this paper: "There is still room in California [Oregon] for thousands of intelligent fruit-growers, such as will plant the right thing in the right place, take proper care of the trees when growing, prune properly, when in bearing thin properly, pick at the right stage of ripeness and pack nicely in clean boxes, fight all damaging insects and fungi with the best implements and insecticides to be had and otherwise use all the intelligence they have in their business. I believe eternal vigilance is the price of good fruit in this or any other country, and for that reason think there will always be a good price for good fruit. Concert of action and union of purpose among fruit-growers is all that is necessary to make fruit-shipping profitable and maintain it so."

Ten thousand square miles of the valleys and foothills of Oregon are in every way adapted to the culture of all the fruits grown in this latitude, of the finest quality and in the greatest luxuriance. Before the advent of the white man and cultivated fruits, this country had demonstrated its capacity to produce the wild fruits abundantly, of fine flavor and excellence. The Indians, trappers and pioneers valued these highly and made good use of them. As they were in some sense evidence of a soil and climate adaptation and prophetic of a great industry now growing up among us, it is not out of place to briefly make some record of them; and this seems the more important in view of the fact that the pomological division of the interior has taken up the subject and is making collections and urging the improvement of indigenous fruits and hybridizing and cultivation and that some of our best fruits have been thus produced.

The Oregon crab apple (*Pyrus rivularis*) is found on cold marshy ground, bordering ponds, mountain springs and streams, and when favorably situated is a good sized tree and attains a diameter of one foot, and an altitude of twenty feet. Its rich green, spreading top in the season bears heavily a small, oval, golden-colored apple, which when ripe is eaten by the Indians, and was used in early times by the white settlers for making preserves, jelly and vinegar. This species has been hybridized

and improved by some of our nurserymen, and no doubt will be further improved, which may lead to a valuable variety in the future.

The Oregon wild plum (*Prunus subcordata*), of which there are two or three varieties, was much valued in early times for its fruit to eat green, for preserves and jam. This plum for quality is about the same as the native red plum of the middle west, and has been improved by selection and cultivation; was used formerly by nurserymen for stock on which to graft the plum and prune. The tree grows to a height of ten or fifteen feet. Another variety produces a round fruit nearly an inch in diameter; another an oblong, resembling in shape, color and quality the Damson, and by those who use them preferred to that variety. Of these something may be expected from hybridizing and cultivation.

We have two or more species of wild cherries; one, *Cerasus demissa*, a shrub or small tree bearing a purplish black fruit, very much resembling the choke cherry, though of much better quality and edible; is used to some extent in marmalade; its roots have been used as stock to work improved varieties upon. The other, *Cerasus emarginati*, sometimes attains to the dignity of a tree one foot in diameter and thirty to forty feet high, and bears a roundish, black cherry about one third of an inch in diameter, bitter and astringent.

The Oregon elder (*Sambucus glauca*) is a character tree of unsurpassed elegance and rare beauty on the lawn or in the forest; is of vigorous growth, attaining two feet in diameter and thirty feet in height, with a beautifully cut leaf of rich bluish green, decked with showy sprays of creamy white flowers six to ten inches across, and in the fall of the year gorgeously arrayed and heavily laden with purple berries, interspersed with green fruit and blossoms, which continue to bud and bloom from June to September, giving a succession of flowers, green fruit and ripe, purple berries the entire season. The berry has a pleasant subacid taste, and with a little sugar is palatable in pies, stewed or in preserves, and properly prepared makes an excellent wine, for which it is now often used. Another variety of smaller growth (*Sambucus pubens*) has a red berry, also edible. This variety is not so widely distributed, and is only found along the coast and up the streams inland.

The grape (*Vitis Californica*) is found in the southern part of the state, and has been much used in other countries as a phyloxera resistent stock, on which to work European varieties. This fruit is something like the fox grape of the east, and has been some improved by selection and cultivation, and will doubtless be of value in the future.

Oregon is a land rich in native berries, which were held in great esteem by the Indians and early settlers, some of which are really fine and yet much sought after and utilized, and form a considerable commerce in our towns and cities.

The wild blackberry (*Rubus ursinus*) is very abundant everywhere, and takes possession of neglected fields, fence rows and burned districts. The fruit is of good size, oblong, very sweet and juicy, and believed by the children and good housewife to be for all purposes much superior to the cultivated varieties. Tons of this fruit are gathered and sold to families, and if there were more pickers a large commerce could be made with the canneries. The Aughinbaugh is a sport from this species.

Of raspberries, we have four varieties—the salmon berry (*Rubus nutkanus*), a large, yellowish, red fruit, with a white blossom, juicy, sweet, highly flavored, very palatable; a red berry (*Rubus leucodermis*), highly aromatic, soft, sweet and very good; a black cap (*Rubus pendens*), not unlike Gregg's black cap, and with us, under cultivation, fully its equal. This berry is widely distributed and abundant. A black raspberry (*Rubus spectabilis*), being rather hard and dry to rank first-class, yet with a peculiar flavor; very palatable to some tastes.

The wild strawberry (*Fragaria chilensis*) is widespread, abundant and very prolific, so that in some regions it is said hogs fatten on them. The berry is not large, but improves under cultivation, and by some is classed superior in flavor to the cultivated kinds. Several fine varieties have been produced by cross fertilization with this, among which are the Triomphe de Gand, True Chili and several other varieties.

We have several wild currants, one a beautiful shrub and sought in the eastern states and Europe as an ornamental lawn plant, and valued for its elegant foliage and early and profuse bloom of pink and scarlet flowers; berry not edible. The yellow currant (*Ribes aureum*) responds well to cultivation, and in the wild state is good sized and edible.

Of gooseberries, two or three kinds are common. *Ribes menziesii* is a large, hairy berry, edible, but rather insipid, and is not much used. Two others are red and brown when ripe, a fourth of an inch in diameter, sweetish, tart; good for culinary purposes; do not know of their cultivation.

Four or more cranberries are found in the state. *Vaccinium parvifolium* is a pale, red berry, small, dry, with a very slight cranberry taste, and not used. *Vaccinium ovalifolium*, high bush cranberry, is a large, blue berry, good and in some localities where fruit is scarce very useful; much sought by the Indians. *Vaccinium microphyllum* is a red, high bush cranberry, smaller, juicy and palatable; only found high up in the mountains.

Another is found in the Cascade and Coast ranges as an evergreen bush, and bears a dark, purple berry; edible. Local botanists speak of other varieties.

The barberry (*Berberis aquifolium*), Oregon grape, so called, is a superb and elegant ornamental evergreen shrub, in leaf somewhat resembling the English holly; in the wild state growing two or three feet high; under cultivation making a showy lawn plant, six to eight feet, with finely cut, polished leaves and symmetrical head; early in spring bearing a profusion of showy, yellow flowers, followed in their season by clusters of dark purplish black berries, the size of wild cherries; altogether a thing of beauty rarely equaled; fruit acid and make a fine beverage, and good pies or preserves. There are others of the barberry family.

The salal (*Gaultheria myrsinites*) is scattered through the dense fir forests of the state; is another beautiful, small shrub, evergreen, bearing an acid, edible berry, size and color of the Oregon grape; much sought by the Indians, and in early days made an excellent wine for the resident Hudson Bay Company employés. The salal is probably a variety of wintergreen, and seems to thrive best in the deep shade of the forests; has not been cultivated.

The service berry, or Juneberry, a small tree six to twelve feet high, we expect to make a good record for in the future. This has been cultivated in other parts of the world and much improved. The service berry in the Willamette valley grows in all soils, and at altitudes as high as the snow line, bearing a sweetish, pleasant tasting berry about the size of our largest wild cherry; as yet it has not been cultivated with us or much utilized.

A black haw (*Cratægus Douglasii*), not unlike the black haw of the middle west, is sparsely found in some localities.

Our one filbert, hazel nut (*Corylus rostrata*), is of the same species as the imported nuts in our market, and closely approximating in size, flavor and quality, and grows everywhere in our valleys, sometimes to a tree ten inches in diameter and from eight to fifteen feet high. No effort is recorded of any attempt to cultivate or improve it.

A kind of chinquapin chestnut (*Castanopsis chrysophylla*), is a symmetrical growing tree, fifty to one hundred feet high, bearing abundantly a small, hardshell chestnut, sweet and edible.

It is not too much to say that all the valleys and foothills of Oregon are fruit lands, and abound in choice spots for the different fruits cultivated in our climate or, more properly speaking, climates. The Coast and Cascade mountain ranges divide Oregon into three distinct, well-defined climatic regions, which may

be further divided into coast and inland, influenced and modified by the altitude of the country and the Japan equatorial ocean current, carrying a warm, moisture-laden air, which gives the whole state a mild and equable climate not found elsewhere in this latitude. Southern Oregon, with sunshine, mild and open winters, seasonable showers and annual rainfall of twenty-five to thirty inches; with warm summers fanned by gentle sea breezes, mean summer and mean winter temperature varying only 11·4 degrees, a productive soil, is altogether a country desirable to live in. Briefly epitomized, Southern Oregon is a great fruit country, now filling up with a prosperous fruit-growing population. Its extensive fruit lands are being largely set to orchards and vineyards, and are soon destined to yield of the finest fruits the sun ever shone upon an hundredfold, and become a source of wealth to its people and the state at large.

In Western Oregon cooler summers and much more rainfall; winters mild, with temperature rarely down to zero; annual rainfall, 55·4; mean winter temperature, 40; mean summer temperature, 64; rains generally warm and without wind; no devastating storms have ever occurred; summers too cool for corn or melons, with daily sea breeze and cool nights; seasonable showers and ample moisture during the growing season; no strong winds.

The Willamette valley, the first settled and the center of the wealth and population of the state, is thirty to forty miles wide and one hundred and twenty miles long, and with the foothills, estimated to contain eight thousand square miles of tillable lands. There is evidence that this for a long time was an arm of the Pacific ocean; a great inland sound, which has deposited off shore old forests, gravel, sand and silt, varying from a few hundred to thousands of feet deep. Mr. Ladd's well near Portland, nearly two thousand feet deep, showed all the way down strata of sand, gravel, decayed vegetation, soil, old forests, drift and marine deposits. Railroad cuts and wells show that this deposit, when brought to the surface from any depth, is rich in all the elements of vegetable growth. So it may be said that we have a deep, fertile soil. The general character of surface soil is a dark, slightly sandy loam, nearly black when wet, with a pervious subsoil of sandy clay. In small tracts in the foothills are found red or light brown loams. The face of the country is gently rolling, or nearly level prairie, with the Willamette river running near the center, fringed with a dark fir forest, interspersed with the oak, maple, ash, alder and other forest trees of Oregon. Occasional clear, wooded streams put in from the mountains on either side, and intersect the valley to the river. The evergreen and picturesque foothills in the distance, running back in waves to the

ever-varying sky line of the darkly timbered mountains beyond, snow-capped Hood, in bold and rugged outline, reaching high above, altogether forming a landscape of surprising beauty and impressive grandeur seldom equalled. Along and among the foothills are numerous little valleys and cozy, quiet home nooks, with here and there an oak opening or clear, running mountain stream, bordered with alder, ash and cottonwood. These unoccupied hills and valleys are fruit lands, and offer a golden harvest to thrift and industry.

Eastern Oregon.— The saturated air of Western Oregon, having passed over the Coast and Cascade mountains and deposited its moisture and given up its heat in the heavy rainfall of Western Oregon, reaches the high plateaus of Eastern Oregon, making the colder and dryer climate of that region, light rainfall and cold winters, warm and dry summers, specially favorable to cereals, grapes, peaches and other of our fruits and vegetables. A prominent fruit-grower of Eastern Oregon makes the following estimate of the yield per acre in his locality on a seven-year-old orchard:—

Apples	40,000 pounds
Peaches	30,000 pounds
Pears	40,000 pounds
Plums	50,000 pounds
Cherries	20,000 pounds

Grapes and berries to the acre:—

Grapes	40,000 pounds
Blackberries	15,000 pounds
Raspberries	15,000 pounds
Gooseberries	5,000 pounds
Currants	10,000 pounds
Strawberries	6,500 pounds

Looking over the whole state, then, may we not summarize and add that among the varied resources of the great commonwealth of Oregon, potent in its capacity for contributing to the material development of the state to its proper position as one of the foremost states of the union, it is not at all too much to say that fruit-growing, if it is not destined to take the first rank, is certainly capable of being expanded into the equal of any? Neither Oregon's forests, its mines, its fisheries, its farms, dairies, cattle ranges, sheep walks nor its manufactories will, in their future growth, be entitled to outrank its orchards if proper methods are adopted by the horticulturists of the state.

Here, under the peculiar climatic conditions by which we are surrounded, blessed as we are by fertile and responsive soil, is, as has been fully demonstrated, the natural habitat of the apple, the pear, the quince, the plum and the prune, in all its varieties. Here, in select localities, flourish the peach, the apricot and the almond. Here, under intelligently considered conditions, the grape, the fig, the pomegranate, the medlar pear, the

Japanese persimmon grow to maturity, ripen and become useful and agreeable adjuncts of the farm and home. Melons and berries are at home here; and, in short, it may be said that, excepting the citrus and other semitropical fruits, Oregon offers to the fruit-grower an exceptionally attractive field for the exercise of all his faculties in this important and most attractive branch of the business of the tiller of the soil.

The early history of fruit-growing presents to the student at once a most romantic and a thoroughly practical and matter-of-fact series of interesting pictures. It is related of some of the earliest settlers in the Willamette valley that nothing more thoroughly and painfully accentuated their isolated condition than the absence of fruit trees on their newly-made farms. Half the beauty and pleasure that brightens the life of youth and childhood, it is not too much to say, is found in the orchard of the old homestead, the sight of the trees in bloom, the waiting and watching for the first ripe fruit, the ingathering of the fruit in the fall, and the storing of it away in bin and cellar for use in the winter around the ingleside.

Is it any wonder, then, that when some of the early settlers were called to Southern Oregon to aid their fellow-countrymen in repelling the attacks of Indians, and finding there wild plums and wild grapes, they brought with them on their return, roots of the former and cuttings of the latter, in the hope that these foundlings of the southern forest would take kindly to a more northern soil? In this act of transplanting was illustrated the world's hunger for the fruit of the vine and tree, so beautifully illustrated by Whittier in his poem commencing with these lines:—

> "The wild grape by the river side
> And tasteless ground-nut trailing low,
> The table of the woods supplied."

The old Puritans could not have been such terribly stern and uncompromising foes of the good things of life after all, since they knew enough to find gustatory delight in such fruits as kind mother nature provided for them in their exile.

So much so for the romantic side of the picture of Oregon's past in fruit-growing.

Turning to the practical side of the subject, it seems fitting and proper that some record should be made of the unwritten pioneer history of this great benefaction fast fading from the memory of man. The intelligent foresight and patient labors of those who inaugurated this industry in the far-off wilds of Oregon are worthy a place in the archives of the state, and should be kept green in the memory of those to come after us.

In the summer of 1847, Mr. Henderson Lewelling, of Iowa, brought across the plains several hundred yearling grafted trees—apple, pear, cherry, plum, prune, peach, grape and berries, a full assortment of all the fruit grown in the then far west. These were placed in soil in two large boxes, made to fit into a wagon-bed, and carefully watered and tended on the long and hazardous six months' journey with an ox team, thousands of miles to the banks of the Willamette, near the little townsite of Milwaukie, Clackamas county.

Here a little patch in the dense fir forest was cleared away with great labor and expense, and the first Oregon orchard was set that autumn with portent more significant for the luxury and civilization of this country than any laden ship that ever entered the mouth of the Columbia. A fellow traveler, William Meek, had brought a sack of apple seed, a partnership was formed and the firm of Lewelling and Meek started the first nursery in 1848. Roots from seedling apples planted at Oregon City and on French prairie, and sprouts from the wild cherry of the vicinity, and wild plum roots brought in from Rogue river valley furnished the first stock. And it is related, that one root graft in the nursery the first year bore a big red apple, and so great was the fame of it, and such the curiosity of the people, that men, women and children came from miles around to see it, and made a hard-beaten track through the nursery to this joyous reminder of the old homestead so far away.

People in those days in this sparsely settled country knew what their neighbors were doing, and in the fall of 1848 and spring of 1849, they came hundreds of miles from all over the country for scions and young trees to set in the little dooryard or to start an orchard; so that the trees were soon distributed all over the settlements of the valley—yearlings selling at 50 cents to $1 each.

The first considerable orchards were set on French prairie and in the Waldo hills and about Salem. Of apples, the following varieties were common: Red Astrakan, Red June, Talman's Sweet, Summer Sweet, Gravenstein, White Winter Pearmain, Blue Pearmain, Genet, Gloria Mundi, Baldwin, Rambo, Winesap, Jennetting, Seek-no-Further, Tulpehocken, American Pippin, Red Cheek Pippin, Rhode Island Greening, Virginia Greening, Little Romanite, Spitzenburg, Swaar, Waxen and a spurious Yellow Newtown Pippin,—since called Green Newtown Pippin,—a worthless variety which has since caused much trouble to nurserymen, orchardists and fruit-buyers, and brought by mistake for the genuine, and other varieties not now remembered.

Of pears, the Fall Butter, Pound pear, Winter Nellis, Sickle, Bartlett and others.

Of cherries, May Duke, Governor Woods, Oxhart, Blackheart, Black Tartarian, Kentish and others.

Peaches, the Crawford, Hale's Early, Indian peach, Golden Cling and seedlings.

Of plums, the Gages, Jefferson, Washington, Columbia, Peach plum, Reine Claude and Coe's Late Red were leading varieties.

Of prunes, there was only one variety, our little German prune, a native of the Rhine, sometimes called the Rhine prune and from which our Italian is a lineal descendant—a sport from its native country.

The grapes were the Catawba and Isabella.

The climate was propitious and the soil fertile and there were no insect pests. Trees grew rapidly, and they were prolific of such fruit as had never been seen before.

About 1850, a Mr. Ladd started a nursery near Butteville, and in the same year Mr. George Settlemeir arrived by way of California with a good supply of fruit-tree seed, which he planted on Green Point, and afterward removed to his present home at Mt. Angel, where, as fast as his limited means would allow, a large stock of fruit and ornamental trees were accumulated, making in all, the largest variety in the territory. Mr. Settlemeir wisely interested his large family of sons in the business by giving them little blocks of ground for side nurseries of their own. J. H. Settlemeir tells, with pride, how he started, at ten years of age, in three fence corners, and at thirteen had one thousand trees and sold one bill of sixty dollars. H. W. and J. H. Settlemeir still continue in the business.

Another nursery was started near Salem, and the pioneer fruit industry was fairly inaugurated. This year Mr. Lewelling went back east and selected from the extensive nurseries of Ellwanger and Barry, and A. J. Downing, a large variety of young trees and plants, which he brought back via the isthmus of Panama, carried across by Indians and mules. This time Mr. Lewelling, to correct his mistake in the Yellow Newtown Pippin, had Mr. Downing personally point out the trees as they were dug. Strangely the same mistake occurred again, and again Lewelling brought out the Green Newtown Pippin, and it was not for some years that the real Yellow Newtown Pippin was introduced into Oregon. The first box of apples placed upon the sidewalk in Portland by Mr. Lewelling was eagerly purchased by the admiring, fruit-hungry crowd, that gathered about, at one dollar per apple, and returned the neat little profit of seventy-five dollars.

The home market now showed many of the above-mentioned fruits, which were eagerly sought at fabulous prices. Apples brought as high as one dollar per pound by the box, and in

Portland retailed at one dollar and fifty cents per pound readily, and all other fruits nearly as much.

Californians, fruit hungry, with plethoric purses, bid high for the surplus, and in 1853, a few boxes, securely bound with strap iron (as was the custom in those days to protect against fruit thieves), were shipped to San Francisco and sold for two dollars per pound.

In 1854 five hundred bushels of apples were shipped and returned a net profit of from one dollar and fifty cents to two dollars per pound. In 1855 six thousand bushels were shipped, and returned twenty to thirty dollars per bushel. Young trees were now in full bearing, and the export of 1856 was twenty thousand boxes. This year one box of Esopus Spitzenberg paid the shipper a net profit of sixty dollars, and three boxes of Winesap were sold in Portland at one hundred and two dollars. From this time to 1869 the fall and winter shipments bimonthly to San Francisco, per steamer, were from three thousand to six thousand boxes.

Our apples are large, of fine flavor, high color and good keeping qualities. Of pears, we grow all varieties, so far as tested, equally well, high colored, of the largest size and unsurpassed quality. In cherries and prunes, for size and quality, we claim to beat the world's record. In peaches, grapes and small fruits, in favored localities, we will not take second place. Our fruits have attracted favorable attention wherever exhibited, and at two world's fairs — Philadelphia and New Orleans — against fifty states and nations, with fifty thousand plates of fruit, Oregon received the premium for the best five plates of hill-grown apples; also for the best five plates of valley-grown apples, and the judges reported that we were entitled to the premium for the best sweepstake apple, but for the mistake of naming the plate Winesap instead of Roman Beauty, which it was. This mistake threw it out, and thus we lost the merited premium.

Our prunes, plums and cherries have never failed to take premiums wherever exhibited. Last season the state board of horticulture received at its office in Portland apples weighing from twenty-four ounces and upward — one apple, Gloria Mundi variety, weighing forty-four (44) ounces; cherries, the Royal Anns, measuring from three and a quarter to three and a half inches in circumference, and a seedling from J. H. Lambert, of Milwaukie, measuring from three and a half to three and three quarters inches in circumference; peaches running from twelve to seventeen ounces, and of the best quality; prunes weighing four ounces — dried product over an ounce — and this is not uncommon. Boston, owing to the large residence of wealthy European families, is the best fancy prune market in this country,

and pays more for prunes and other fancy dried fruits than any other city.

At the chamber of commerce in Boston this season, Mr. C. H. Ricker, residing near here, exhibited the Italian prune as grown and dried on his place. The fruit attracted great attention. The best experts were called, who know the prune as it is offered in the markets of the world, and they pronounced this prune the equal if not the superior to any they had seen. This sounds large, but is true, and will stand so in the markets of the world.

The Royal Ann cherry (*Napoleon Bigareau*), as grown in Oregon, is without a rival; is of the largest size, averaging, commonly, nealy an inch in diameter, of superior quality, unsurpassed for shipping or canning, and makes a good dried product. The The tree is vigorous and gives a regular and large yield, which brings the highest prices wherever offered. Our seedling, the Black Republican, has been well tested, and now has a national reputation; is large, of good quality and a regular bearer of late fruit, which can be shipped across the continent. We have three other seedlings of great promise, which in size exceed all record, running from one to one and a third inches in diameter.

Our Bartlett pears have always been in great demand. The tree yields regularly a heavy crop of the largest fruit of first quality and has paid the grower a handsome dividend. This list might be extended. Perhaps enough has been said to indicate the fact that we have a fruit country.

The Italian prune is a large, palatable fruit, a good shipper and yields thirty-three per cent. when dried, making a showy, black prune, excellent as a "confection" to eat out of hand, requiring little sugar and of the finest flavor when cooked. The tree is free from all pests, stocky and vigorous; is a regular bearer, carrying its fruit well distributed and requiring no thinning; remarkable in the respect that it sheds all fruit it cannot perfect to a good size, according to the dryness of the season. The tree responds to good treatment, but does tolerably well in the grass plot and under neglect, and has been called "the poor, shiftless man's tree." This prune brings in the eastern markets two cents per pound more than any other prune grown on the coast and is favorably known as the "Oregon prune," and is destined at no distant day to be a leading commercial export. But it is pertinent and proper to say that much talk and many published statements about large yields and net profits of from $500 to $750 and upward per acre annually, notwithstanding they are true, are misleading and should not be considered in a business proposition. These are rare and fortunate exceptions in favored localities, under exceptionally favorable circumstances, and will not apply to the general grower. One, two or three hundred dollars per acre net

returns annually, according to the locality and orcharding skill and pecuniary ability of the man, is good enough. This is a reasonable, conservative estimate which may be relied upon, leaving the rest to the possible and hopeful dream of the visionary. Our prune industry is now of considerable importance commercially. Many young orchards are coming into bearing, and a large area will be set to this fruit the coming season. This is now the leading fruit product of Oregon and will continue to be so.

FRUIT.

NATURE'S GREATEST GIFT TO MAN.

By WILLIAM H. GALVANI.

* * * My dear, my native soil!
For whom my warmest wish to Heaven is sent!
Long may thy hardy sons of rustic toil
Be blest with health, and peace, and sweet content.
—BURNS: The Cotter's Saturday Night, xx.

Horticulture is undoubtedly the most important branch of agriculture, since it embraces the cultivation of fruits, vegetables, flowers and the various ornamental trees and shrubs, and it yields so much more to the acre and to industrious effort than either grain or livestock—the chief products of the farm. Not only is it the most useful branch of human effort in the struggle to obtain from mother nature the products necessary for our sustenance and comfort, but it is also the most ennobling and attractive. From the floating perfumes of the garden the human being, no less than the birds,—those winged and cloud-cleaving ministers,—derives one of the purest of human pleasures, a perpetual pleasure, and one that is free from the pain and disappointment which are the inseparable companions of almost every worldly human pleasure. True is the observation of one of the ancient classics: "The sweet smelling exhalations of perfumes, flowers and meadows, conduce no less to health than to enjoyment."[1] Indeed, horticulture is the ideal part of agriculture, and without it no farm is ever sufficient to enable one to receive the comfort and satisfaction this most natural mode of living affords to the human being; in it mother nature has united the useful and the ornamental in most perfect harmony. It is there, in the garden, where life's struggle finds "Wreaths for each toil, a charm for every woe."

Horticulture should therefore be encouraged with all possible means at our command, since it affords the safest road to human happiness, the aim and end of life. This can best be done by a legitimate increase in the demand for its products, which, like those of the farm and field, are among nature's chief provisions

[1]Plutarch, De Isis et Osiris, LXXX.

for our sustenance and comfort. Our efforts should therefore be directed toward convincing humankind of the superiority of fruit as an article of food over the other products used for the same purpose. The most effective way of accomplishing this is by calling into service the hard-earned wages of knowledge, the wisdom of the world. Let us turn on the light, and the lamp of experience will scatter all doubt and darkness; and nature's testimony, from the remotest past up to present times, as well as scientific evidence, will proclaim in unmistakable terms its verdict as to the usefulness and superiority of the many herbs and fruits, which are as numerous as the drops of rain or the golden beams that gave them birth. This would necessarily result in an increased demand for nature's greatest gift to humankind, since "men have always felt the greatest anxiety about practices connected with health,"[2] and self-interest and effort would at once proceed to utilize nature's unlimited resources to keep up the supply with such increased demand. This would mean more acres under orchard, more people engaged in fruit-growing, more interest in horticulture, and a possibility for greater usefulness on the part of those interested in the subject. It would, also, more than anything else, play a most important part in the solution of the most perplexing problem of today, the problem of the unemployed, whose ranks are daily increasing at such an alarming rate, chiefly on account of the introduction of labor-saving machinery into our modern industrial world.

It is, therefore, eminently fitting for the Oregon state board of horticulture to inquire at this time into the nature of fruit and its usefulness from a dietetic standpoint, in order to show the superiority of the product of the orchard over other articles of food used by the human family, and, as far as possible, to present in a popular form the advantages to be derived from an increased use of the different fruits. This the writer of these lines, who has given considerable time to the investigation of the subject, and whose experiments with fruit as an article of diet extend for a period of about ten years, will now, in obedience to the request of the Oregon state board of horticulture, endavor to prove.

THE ANTIQUITY OF FRUIT.

> Nature never gives one lesson and philosophy another. —JUVENAL, Sat. XIV.

> To man alone hath nature given the power of seeing and judging consequences.—PLUTARCH: De El apud Delph., VI.

[2] Plutarch, De Isis et Osiris, LXXX.

From the earliest history of the formation of our planet, the geological period known as the carboniferous age, which is characterized by the formation of about nine tenths of all the workable coal in the world, and the appearance of the first known amphibians and first reptiles, the earth's crust reveals a good representation of forest and marsh as well as marine vegetation.[3] Of these, many commenced still further back in our earth's history, the devonian age, represented by the first known fishes, and even the silurian age, when no vertebrates are known to have existed. The remnants of plants of those ages, it is true, are very scarce, but it must be remembered that any portion of vegetable tissue is so much more subject to destructive agencies than are the hard parts of animals;[4] otherwise, the number of plants in a fossil state would undoubtedly be more numerous. But both, the vegetation and conditions necessary for their preservation, culminated in the carboniferous age, and the fossil species of plants are found mostly in the form of stumps, and logs, and fruit and leaves; the nut-like fruits particularly are found in the coal system in great numbers. Considering that, according to Bischoff's calculation, the formation of the carboniferous strata required a period of more than a million years, and that the time when the first living forms appeared in the earth and the oldest stratafied rocks deposited, down to the present day, represents, according to conservative estimates of geologists, a period of at least 100,000,000 years,—the antiquity of fruit becomes as marvelous as self-evident. So much for the message from the silent pages of our mother earth. Let us turn to the evidence from recorded history as to the antiquity of horticulture.

FRUIT IN HISTORY.

> There is not anything in this world to be compared with wisdom for purity.—BHAGAVAD-GÎTA: IV:38.

> There is nothing more important for a man to receive, or more noble for a god to grant, than truth.—PLUTARCH: De Isis et Osiris, I.

Fruits of some kind, according to recorded history, have been cultivated from the earliest historic ages among the most ancient inhabitants of India, China, Persia, Egypt, Babylon and Palestine. The celebrated gardens of Babylon (B. C. 2230–323) are spoken of by the historian Diodorus, a contemporary of Emperor Augustus (B. C. 63; A. D. 14); by Strabo, the geographer (B. C.

[3] Dana, Manual of Geology, p. 321, 3d ed.
[4] LeConte, Elements of Geology, p. 287, ed. 1882.

54; A.D. 24), and by others. The biblical accounts of the prodigious size of the grape,[5] the pomegranates, the figs and the olives of Canaan, before the conquest (B. C. 1500), are as remarkable as interesting. So are the fruit festivals,[6] the regulations concerning the planting of gardens and vineyards,[7] the restrictions concerning the gathering of fruit and the freedom extended to all passersby and strangers to enter any of the gardens and vineyards, regardless of what we term in modern times "property rights," and eat as much as they wished.[8]

Greece and Rome derived their knowledge of fruit-growing from the far east, whence many of the finest varieties have been obtained and transplanted. Homer, the greatest epic poet, who lived about 1000 B. C., gives are markably fine description of a cultivated garden, containing apples, pears, figs, olives, pomegranates, grapes, beds of various herbs, etc., in which the fountain feeds the streams, and every stream "Visits each plant and waters all the ground."[9] The sacred groves of the Greeks, which contained ornamental and odoriferous plants and fruit trees, particularly olives and vines, were cultivated with much care. Xenephon, the historian, philosopher and warrior, whose life the great Socrates saved (B. C. 424), speaks of the extensive parks[10] and of groves "of cultivated trees bearing whatever fruits are eatable in the different seasons."[11] Longus, in the fifth century B. C., repeatedly mentions and describes in most elegant language a garden containing every production for each season: "In spring, roses, lilies, hyacinths and violets; in summer, poppies, pears and apples of every variety; in autumn, vines and figs, pomegranates and myrtles."[12] Additional references may be found among many other Greek writers long before the present era.

In Rome we find the Floralia, a five-day festival (April 28, May 4) having been instituted about 238 B. C., in honor of the goddess Flora, for the purpose of obtaining from her the protection of the blossoms[13] The "Horreum," a place for keeping fruit, corn and all sorts of provisions, is first mentioned in the second century B. C. Seneca, the great stoic philosopher (B. C. 4, A. D. 63), the favorite classic of the early fathers of the church, calls even his library a "Horreum."[14] And Columella, his contemporary, wrote a voluminous production treating of agriculture, of the cultivation of the vine, olives, of gardening, cat-

[5] Num. XIII: 23, 24.
[6] Lev. XIII: 39-41.
[7] *Ibid.* XXV: 3-6.
[8] *Ibid.* XIX: 10; 10 Deut. XXIII: 24, and XXIV: 20, 21.
[9] Odyssey, VII: 112-130.
[10] Anabasis, I, ii, 7.
[11] *Ibid.* V, iii, 12.
[12] Pastoralia de Daphnide et Chloe, Lib. II.
[13] Ovid, Fast., V: 185; Plinius, Hist. Nat. XVIII: 29.
[14] Epist. 45.

tle, bees, etc.,[15] and, at a still earlier date, Varro, "the most learned of the Romans" (B. C. 116–28), when about eighty years old, wrote the most important of ancient works upon agriculture,[16] which is considered "far superior to the voluminous production of Columella." Plinius (A. D. 23–79) speaks in his works of forcing houses for grapes, melons, etc.[17] Martial (A. D. 43–104), the epigrammatic poet, frequently mentions conservatories and hothouses used to preserve foreign plants and produce flowers and fruit out of season,[18] and a full description of a Roman garden can be found in a letter of Pliny the younger, A. D. 61.[19]

From and after B. C. 70, varieties of fruit were introduced throughout Italy. The Romans begun the introduction of gardening into Britain, but not until after the year 1500 has the introduction of fruits and flowers into England become general.[20] Charlemange (A. D. 768–814), has done much toward the establishment of fruit-growing throughout Europe, and the monks of the middle ages carried on the cultivation of fruits very successfully in their monastic institutions. They were among the first in modern times to discover how noble this is for the mind and how pleasing a variety of labor it affords for the hands. Since then it spread throughout the territories occupied by the civilized races.

Such, in brief, is the history of fruit-growing. As to the use of fruit—let us turn to tradition for its antiquity and to science for its value.

FRUIT IN TRADITION.

> Wise maxims have been of old laid down by men; from these it is our duty to learn.—HERODOTUS (B. C. 484), I:8.

> Behold, I have given you every herb-bearing seed, which is upon the face of all the earth, and every tree in which is the fruit of a tree yielding seed; to you it shall be for meat.—GENESIS, I:29.

One of the most remarkable facts in connection with fruits and herbs is that we find among all European and American races traditions regarding an Edenic period, a "Golden age," the first period of their existence upon this planet. No less remarkable is the fact that every one of these races looks back to that "Golden age" as its happiest period of existence, one of contentment and peace, the fortunate period of innocence and ease, when running streams, budding plants, delicious fruits and

[15] De re Rustica.
[16] De re Rustica.
[17] Hist. Nat. XVI: xxxiii, 60; XIX, v, 23.
[18] Epigr., XIII: 127.
[19] Epist., V: 6.
[20] Hayden, Dict. of Dates.

the soft beams of the sun, the idol of early nature, supplied all their wants; and when, in the language of Ovid, the æsthetic and cosmopolitan poet of the Roman Empire,

> "No walls were yet: nor fence, nor mote, nor mound,
> Nor drum was heard, nor trumpéts angry sound;
> Nor swords were forged; but, void of care and crime,
> The soft creation slept away their time." [21]

But the actual significance of these traditions assumes a much greater importance when we realize that it is generally accepted among those of any standing in the scientific world that all evidence points to the unmistakable fact that man is a native of the tropics, where the marvelous abundance of fruit of the most luxuriant varieties, the chief characteristic of those regions, fed and sustained our progenitors in comfort and ease. This, too, remarkably corresponds with the idea that primitive man, whereever he was first cast, whether in one center or in more, must, of necessity, have obtained his food from the plant world, since it is impossible to imagine him commencing his career learned in the arts of hunting, killing and cooking animals for food. Again, among the same races we find traditions regarding flood and deluge catastrophes which visited this planet, at one time or another, and thus terminated their "Golden age." This, too, remarkably corresponds with what is termed in geology the glacial period, or that of the drift, the first of the three periods of the quatenary age and era of man, when a heterogeneous mixture of clay, sand, gravel, pebbles, boulders, unsorted, unstratified and unfossiliferous, have been transported from places, commonly in higher latitudes, by some agency which (1) could carry masses of rock hundreds of tons in weight, and which (2) was not always dependent for motion on the slopes of the surface.[22] Thus the silent pages of the world's history, as recorded in imperishable characters upon the earth's crust, proclaim the validity of the traditions regarding some great desolating catastrophe, which, at one time or another in the world's history, has befallen our remote ancestors; and it is some disaster of this nature which must have put an end to their garden period of existence, when, under the stern yoke of necessity, they were obliged to utilize for their sustenance anything in the shape of organic matter and thus adapt themselves to the new situation, willing or not. At least for the time being.

But as time rolled on that appalling state of affairs has gradually come to a close, and we find that ever since there are any records of human thought and opinion the philosophers and

[21] Metam, 1.
[22] Dana, Manual of Geology, p. 527.

poets of every age and clime, these inspired interpreters of nature's laws have always endeavored to get the human family to return to the kind of a life they led before the period of desolation had done its deadly work. Thus it is "nature never gives one lesson and philosophy another," and hence their numerous declarations on this subject. The scope of this contribution, however, demands brevity, otherwise an exceedingly interesting collection of precepts, views and sentiments on this subject, culled from the writings of the philosophers, poets and religious teachers of all ages, would be given here. It is, however, sufficient to briefly call the attention of the reader to the fact that Homer, about three thousand years ago, noted in his Iliad those who lived upon the fruit of the earth and the milk of the herbs as the most righteous of men, "renowned for justice and for length of days"; that Pythagoras, one of the most celebrated of Greek philosophers (B. C. 570), declared that the first principle of practical philosophy is that of adopting a diet of fruit and herbs to the exclusion of all else, and this doctrine his disciples had to embrace before their initiation into what is known as the Pythagorian school of philosophy; the cynics, too, taught that "men ought to live simply, using only plain food in moderate quantities, some of them subsisting upon nothing beyond herbs and cold water."[23] So have most other philosophical school and individual philosophers and poets of Greece taught and practiced this doctrine.

Of the great Roman writers we find that Ovid (B. C. 43, A. D. 18) called upon humankind to adopt a diet of fruits and budding plants, "as in the days of old — the age which men call golden." So have Musonious, Plutarch, Porphyrius and others. The same is true of the most important religious teachers of antiquity and of modern times, of many of the sects of ancient times, of the hermit fathers and of the ascetics of both east and west.

The question that now suggests itself is, "What is the real significance of all this testimony?" Is it possible that animals only are endowed with the instinct that enables them to unerringly select their food and to distinguish the wholesome from the injurious, while man alone, with all his noble qualities, and with an intellect that passes understanding — is he, with all his exalted powers, unable to understand this matter as unerringly as all other living creatures? And if he is able to do so, is it possible that the wisest and best of humankind, of every age and clime, have erred in their belief and practice as to the most natural food provided by our all-mother for the human family, and that

[23] Diogenes Lærtius, VI, p. 258.

those who have through all ages been impelled and led to the cultivation and use of fruits and herbs have acted contrary to nature's design? If the advice of the brightest intellects of all times was sound, and the industrious work of horticulturists in obedience to nature's decrees, at a time in the world's progress when the sciences of anatomy, physiology, chemistry and national economy were hardly known,—what shall we say now, when these sciences continually add testimony to the validity of their views and efforts, and yet, in the face of all these facts before us, we continue to disregard the choicest food which mother nature has provided for us in so marvelous an abundance. Let those who read these lines answer these questions in accord with the light of their own reasoning faculties, and, whoever will attend to this matter as well as to other affairs in daily life, a reward of good health, sound mind and long years will be theirs. Such are the priceless gifts mother nature bestows freely upon those who live in full obedience to her laws.

THE VOICE OF SCIENCE.[24]

> True wisdom consists in not departing from nature and in moulding our conduct according to her laws and model.—SENECA, De Vita Beata, VIII.

> In proportion as men gain a greater knowledge of the laws of life, they come to have less confidence in themselves, and more in nature.—SPENCER, Education, IV, p. 231.

Every human being, like every other living creature, is impelled by nature to strive to hold on to life. According to Spencer's definition, life is "the continuous adjustment of internal relations to external relations."[25] To sustain life, or to carry on this continuous adjustment, every living being depends upon various organic and inorganic substances, which must be taken into the organism, and, by the process of digestion, be fitted for absorption into the system. Upon this depend our physical and mental well-being, and upon these depends our capacity for activity, which must be exerted in the production and satisfaction of human wants.

A careful study of the subject reveals the fact that food performs two great functions in the organism: It supplies, *first*, the

[24] It is extremely difficult to treat the scientific side of the question without going into many details which would extend this contribution beyond the intended limits. Hence, it is to be hoped that the reader will make due allowance for the incompleteness of this important and interesting side of the argument. It is probably needless to say that this contribution is presented to the consideration of the reader for the purpose of convincing him, by the process of reasoning, based upon definitely ascertained facts, of the superiority of fruit as an article of food, in order to extend the use of this most excellent product in accord with its priceless merits.

[25] Spencer, First Principles, p. 84, 1891.

animal heat without which all activity would come to an end and, *second*, the materials for the repair of the waste constantly taking place in the tissues.[26] The combination of the oxygen of the air with the carbon (starch, sugar, etc.) contained among other substances in our food, gives rise to internal combustion by which the animal heat is supplied; and the nitrogenous element of our food, having no affinity for oxygen, is thus preserved, and is absorbed by the organism in the way of repairing its constant wear and tear. Our food must therefore contain these two elements in a proportion that has been satisfatorily determined; and these with a proper admixture of certain salts and acids, enable our digestive laboratory to properly carry on the work of transforming and absorbing the materials necessary to sustain life.

Of all sources of supply whence these food elements are drawn, the plant world is the chief. In fact, it is the only source, for even the animals humankind feeds upon are originally made up of the substances derived by them from the plant world, since animals only transform the food they consume and do not form any new combinations of these materials. This is a fact well known to those engaged in stock-raising, no less than to the scientist. There is, however. this important difference between the food obtained from the flesh of animals and that furnished by the edible substance of plants; animal flesh is made up of nitrogenous compounds—albuminoids—with little fat and certain stimulating extractives of no food value, such as creatin, creatinin, carnin, etc., due to the metabolism or retrograde metamorphosis (decomposition) of the albuminoids, with traces of volatile oils, that give it the peculiar and distinguishing flavor "which disguises the real poverty of the substance, and it should be classed with such nervous stimulants as tea and coffee."[27] The chief feature of foods obtained from the edible portion of plant substances is that these contain starch and sugar, which are entirely absent in animal flesh; the pulses abound also in nitrogenous matter; nuts, in oils; and fruits, in vegetable acids, such as citric, tartaric, malic, etc., which not only act as powerful disintegrators of the earthly deposits in the human system, but also "relieve thirst, rouse the appetite and aid digestion by increasing the flow of saliva and gastric juice."[28] There is also a medicinal value to the foods obtained from the plant world, and everyone is no doubt well acquainted with the fact that we resort to plants for substances containing healing and soothing properties in the hours of pain and disease. But it is chiefly with the

[26] Buckle, Hist. of Civ. of England, vol. I, p. 40, 1891.
[27] Edward Smith, M.D., LL.B., F.R.S., Foods, p. 89.
[28] Dr. J. Mitchell Bruce, Materia Medica and Therapeutics, p. 128.

nutritive value of foods that we are here concerned, and these are thus summed up by one of the most eminent authorities on the subject, who, without any intention to advocate any food product to the exclusion of all others, declares that in the plant world "we find not only the organic matter, but likewise inorganic matter we require," and hence, concludes he, it "contributes in a complete manner toward the supply of what is wanted for animal nutrition."[29] This declaration is not a mere opinion or speculative proposition, but it is based upon the fact that the science of nutrition has of late years advanced to a stage where it has become a matter of definite quantities of income and expenditure, since every food substance used to sustain life has been chemically analyzed, its constituents numbered and weighed, and the connection between these food elements and the human organism satisfactorily established.

Next in importance to the necessity of selecting our food so as to obtain the required amount of heat-giving and tissue-supplying elements in the best possible form, is the subject of the conditions and the expenditure of energy required in absorbing and distributing these elements through the body whereby these are converted into heat and tissue. To obtain the most nutrition of the food substances taken into the system with the least expenditure of energy on the part of our digestive organs in the absorption of the same, is a proposition of the most vital importance to all; and, to the great majority of humankind, it is of equal importance to obtain these at the smallest possible cost. It must be remembered in connection with this statement that "the more the labor of digestion can be economized, the more energy is left for the purpose of growth and action";[30] and the smaller the cost of obtaining the quantity of food that can supply us with a complete nourishment, the better are we prepared to obtain the other items necessary for our comforts and satisfaction, since, according to reliable estimates, the average wage-earner expends about sixty-five per cent. of his total earnings in obtaining his food only. Furthermore, it is an universally accepted fact that an expensive or elaborate diet is the cause of most of the disorders of the digestive organs, while a simple diet is as inexpensive as it is excellent from any hygienic standpoint. This fact has been known to our remotest ancestors, and one of the most excellent writers of antiquity tells us that "there was a column set up in the temple of Thebes containing a curse engraved thereon against King Mnevis, the first who drew away

[29] F. W. Pavy, M.D., F. R. S., Treatise on Foods and Dietetics, p. 34.
[30] Spencer, Education, IV, p. 235.

the Egyptians from their old way of living, without voyaging, without money, and of primitive simplicity."[31]

Among the other conditions necessary for a healthy and complete digestion are: *First*, moderation in quantity; and, *second*, the imperative necessity of using such foods as contain vegetable acids; by the former we accomplish a more complete digestion than when either a large or small quantity is taken into the system, while the vegetable acids not only aid digestion, but carry on a life-preserving work by disintegrating the earthly deposits of which the constant accumulation in the human body cause ossification and interfere with the natural functions of the physical organs, and thus obstructing the proper and healthy circulation of the blood. Unless this ossific, or calcareous matter deposited steadily in the body, is, as far as practicable, dissolved, old age comes upon us and overtakes us long before it would have reached us had we kept this enemy from making its deadly inroads upon our physical organism.

A brief summary will help the reader to recall the chief points of this argument in favor of fruit as an article of food. Brief as the subject has been treated in this contribution, the following propositions, well ascertained and established, suggest themselves to the reader: Our food is obtained from either the plant world or the edible substance of the bodies of animals. While the flesh of animals undoubtedly contains many nutritive elements, though in a less desirable form than we might find the same in vegetable substances, with the exception of fat, which is very undesirable on account of its indigestibility,—animal flesh contains no heat-giving substances, such as starch, sugar, etc., nor any of the necessary vegetable acids; on the whole, flesh foods are best digestible when eaten raw, but in order to fit them for food they must go through the process of cooking, and this is just what makes their absorption and assimilation so heavy a tax upon the digestive organs; from the point of hygiene animal foods are the chief source of most of the skin, kidney, stomach and other diseases, which make life, whatever there is of it, not worth living; and from the point of national economy animal foods are altogether too expensive, since, according to most reliable estimates, a given tract of land will support ten times as many human beings when utilized for cereals and fruits, as it would when devoted to livestock. The plant world, on the other hand, furnishes the necessary heat-giving and tissue-forming elements, and an excellent abundance of the indispensable salts and acids; on the whole they are easily digested, more economical as to quantity of land required and effort to be ex-

[31] Plutarch, De Isis et Osiris, VIII.

pended in their production, and of untold value from an hygienic and therapeutic standpoint. That mother nature intended us to profit by these many blessings and advantages there is the further evidence that in the anatomical makeup, in the general structure of the human being, in the minute structure of the tissues, and in chemical composition, as well as in the structure of the brain, man is built upon the same model as the fruit-eating animals, the anthropomorphous ape. An examination in the diatectic habits of the European races will soon convince one that those who subsist chiefly upon the products of the plant world also live, as far as possible, in accord with nature's design, since they are not subject to so many diseases and live to an older age than those who discard the food furnished by the plant world. What a world of truth there is in the observation of one of the noblest writers of the last century—"The nations that subsist on food obtained from the plant world are of all men the handsomest, the most robust, the least exposed to diseases and violent passions, and they attain the greatest longevity."[32]

CONCLUSION.

> When man is himself speeding onward, God also lends a hand.—ÆSCHYLUS (B. C. 525-456): The Persians.

> * * * It is a goodly sight to see
> What heaven hath done for this delicious land.
> —BYRON: Childe Harold, 1, 15.

Reader, we are living in an age of mighty changes: Steam, electricity and labor-saving machinery, and mechanical appliances in every conceivable and inconceivable form and shape are continually replacing human effort in this world of manufacture and trade. The question of the alarmingly increasing numbers of the unemployed, not only in any given place, but throughout the civilized world, is becoming more serious and perplexing from day to day. The strange drift of the rural population into modern cities already crowded and full of poverty and underfed toiling millions—all "This bodes some strange eruptions to our state." It is true that philanthropists are trying to relieve much of the distress by dispensing some charity; that statesmen and politicians are trying to do what they can to keep things from getting worse; while an almost infinite number of individuals, many of whom no doubt are sincere enough, but the vast majority of whom is made up of a lot of ambitious phantom-chasers, eternally striving to raise themselves above each other,

[32] St. Pierre (1737-1814), Harmonies of Nature, vol. IV, p. 357.

are inflicting upon the distracted minds of the masses all sorts of conflicting isms and schemes, promising many wonderful things for the relief of all forms of distress. But in the midst of society, divided by so many prejudices, where the spirit is in constant state of agitation, what avail all these confusions as affecting anything permanent?

Everyone, however, fully recognizes that the fierce struggle of the average human being is practically a struggle for daily bread· A survey of the past leads us to the unavoidable conclusion that when our progenitors depended upon the soil they enjoyed their plenty, and enjoyed it in peace. These priceless gifts our all-mother still holds out to us. The question that suggests itself is, are we willing and strong enough to retrace our steps and get back to the fields and gardens, among the golden grain, the delicious fruit, the sunshine and the flowers, where, not being in any one's way, we can find besides peace and contentment also a sound body and a sound mind; or, shall we persist in our fatal errors at the expense of strife, want, diseased body and degraded mind, and act like the little insects, which, for the love of the artificial light of the lamp, sacrifice their lives by crowding about it?

Aude sapera—dare to be wise—is an old maxim, and remember it is you who must make the choice and abide by its consequences; therefore,

> "Choose well; your choice is
> Brief and yet endless."

EDIBLE MUSHROOMS.

By Dr. Harry Lane.

I have been asked to write a paper upon the subject of edible mushrooms of Oregon for publication in the biennial report of the honorable board of horticulture for this state. Before doing so, it is but fair to state that my information upon this subject is limited and comprises but about a dozen different kinds which are common to the immediate vicinity outlying the city of Portland. Inasmuch, however, as the common stock of knowledge seems to be confined to but one specimen of edible fungi, the *Agaricus campestris*, or common meadow mushroom, it may serve a useful purpose to call attention to others which are common, at times abundant and at all times a useful and nutritious addition to the ordinary bill of fare. Some of these varieties excel the ordinary meadow mushroom in delicacy of flavor; most of them, however, do not. There are over 100 varieties of edible fungi. Of this number I am able to positively identify but little more than a scant dozen, or so, while I have found many others which I could not identify, some palatable. Many more have such unsavory characters of taste and odor when cooked that I have willingly foregone further acquaintance with them.

There can be do doubt that the economic value of many wholesale species which daily go to waste is very great, and it is a desire to call attention to this waste of what might be a source of valuable food supply, which impels me to write upon this subject. Such information as I have gleaned has been gained by carefully comparing specimens with the accurate description and beautifully colored illustrations to be found in the various Smithsonian reports of recent years, and the superb work upon "Edible Toadstools and Mushrooms," by the late W. Hamilton Gibson. All descriptions which follow, with the exception of one or two slight variations in the *Russula*, due to local conditions of habitat, perhaps, and noted, are copied literally from Gibson's work and all credit for the same should be awarded to him.

Agaricus campestris, or common meadow mushroom.—This species is so well known that no description from me is needed.

Agaricus (*Amanita*) *muscarius*, poisonous *Amanita* or *Fly Agaric*.—This variety of the agarics is one with which everyone should be acquainted, as it is the variety, more than any other, which is responsible for deaths due to

mushroom poisoning. In Russia it is used for the purpose of poisoning flies, hence its name. It grows in open woods, upon highlands as well as in the soft earth of bottom lands. It appeals to one with its bold beauty and exquisite symmetry from fence corners and scattered thicket, and entices one alluringly from the edges and outskirts of meadows and glades. Its most salient features, as given by W. Hamilton Gibson, are as follows: Pileus, or cup: three to six inches in diameter, quite flat at maturity. Color: brilliant yellow, orange or scarlet, becoming pale with age, dotted with adhesive white; at length, pale, brownish warts, the remnants of the volva or veil, in which the young specimen is enclosed. Gills: pure white, very symmetrical, various in length, the shorter ones terminating under the cap with an almost vertical abruptness. Spores: pure white. Stem: white, yellowish with age, becoming shaggy; at length, scaly, the scales below at base of stem appearing to merge into the form of an obscure cap, volva or veil; often obscure, indicated by a mere ragged line of loose oatward-curved shaggy scales around a bulbous base. Flesh: white. Anyone finding such a specimen need not look far to find others in their various stages of growth, from the bulbous egg-shaped "button" up to the full-grown specimen. In taste I have found this poisonous mushroom to be sweet and nutty when cooked, giving to the palate no warning of its deadly qualities.

Another mushroom, two varieties of which I have found growing in open timber on highlands, is the *Russula alutacea* or yellow-gilled mushroom, and the *Russula lepida* or purple *Russula.* In open fir timber lands the *Russula* is perhaps the most common variety met with. It grows singly in scattered groups among second growth firs and attracts attention by its red and purple cap, its white or yellowish gills and extreme fragility and brittleness. No more savory or delicate morsel comes to the pan than these two varieties of the *Russula*; in fact, I esteem them more highly than any other variety which I have yet found. The following descriptions, taken from W. Hamilton Gibson's work, with the exceptions which I have noted, are so accurate that they may be easily identified:—

Russula alutacea, yellow-gilled *Russula.*—Pileus, or cap: firm, solid at first convex with flat top, ultimately rising from center to rim. Color: very variable from bright to deep red. Cuticle: thin at rim, where the lines of junction of gills are readily seen from above by the depressed channels. Gills: equal, brittle, broad, yellow-buff color in all stages. Stem: solid, milk white, commonly stained or streaked with red toward the base. Taste: sweet and nut-like.

Russula lepida, or purple *Russula.*— Pileus or cap: in shape like above, varying in color from bright red to dull, subdued purplish, with a distinct bloom. Gills: white, broad, principally even, occasionally forked; like the above, extremely brittle. Stem: solid, usually stained and streaked with

pink. Taste: sweet and similar to above. Average diameter of extended pileus of each about three and one half inches; veil absent in each. Habitat: woods. To be found in Oregon in the spring, fall and early winter. The exception which I wish to note to the above description is that I have found the stem to be solid in only exceptional specimens; usually the stem is pithy. Again, where they are extremely brittle it seems to be due to their wormy condition, though, to be sure, they are brittle at best.

Agaricus ostreatus, or oyster mushroom.—This variety may be found growing upon the trunks of old trees and upon logs and grows at times in large masses. When gathered, while young, and used while fresh it is a fairly good variety. However, if kept in a warm room for a few hours, it turns sour and spoils. It derives its name from its supposed similarity in taste to the oyster. The description from Gibson is: "Pileus or cap: four to six inches in diameter, smooth. Color: dull, light yellowish; sometimes pale, ochre or grayish. Gills: dingy white, of various lengths, extending down the stem. Stem: short, or obsolete, on the side of pileus. Spores: white. Taste: agreeable, suggesting the flavor of the cooked oyster. Texture: tough in older specimens. Odor: pleasant. Habitat: as given above."

Coprinus comatus, or shaggy-mane mushroom.—This mushroom is to be found in the spring, fall and early winter, growing in great clumps in garden land, lawns and in rich soil, and is equally as fond of the newly-worked ground of railway and wagon road embankments, where it springs up in clusters or rows in great quantities. It is a delicacy fit for a king, and is the most easily identified of all varieties, except, perhaps, the *Morel Gibson*. Description is as follows: Pileus or cap, egg-shaped in young specimens; at length more cylindrical and finally expanded, melting away in inky fluid. Color: creamy white, becoming black at edge with advancing age, as is also the case with the shaggy point up its surface, which generally cover the pileus. Gills: crowded; equal in length; creamy white in young specimens, becoming pink, brown and finally black, and always moist. Stem: cylindrical; creamy white; hollow, or with a loose, cottony pith. Spores: black, falling away in drops. Taste: sweet, which applies only to the pink or white condition, at which time alone the species is considered esculent. Diameter of cylindrical pileus in average specimens, two inches.

Coprinus atramentarius, or the inky toadstool.—This species is to be found in gardens, lawns, barnyards and around old stumps in the woods. Gibson says of it: "In this species the shaggy feature is absent, there being merely a few slightly raised stains at the summit of a brownish color. The stem is white and hollow. The surface of the cap is smooth and of a Quaker-drab color, occasionally of dirty white or with a shade of ochre, moist to the touch, darkened by rubbing. In the eatable stage the caps are drooping. Pileus: fleshy, moist at first, egg-shaped; of a Quaker-drab,

dirty white or even pale-brownish color, at length becoming expanded, umbrella-like, when it melts away in inky drops. Gills: broad and crowded, not adhering to stem at top; creamy white in young specimens, becoming pinkish gray and at length black. Stem: firm, white, hollow. Spores: black, shed in inky, liquid drops. Taste: sweet, as is also the odor, which applies to its early stage only. Usually grows in clusters, often so dense as to flatten and compress the central individuals into hexagonal shape. It is claimed that all species of the *Coprinus* are eatable when young and before turning dark in color.

We now come to an edible mushroom which looks to be anything but good to eat. Upon the contrary, its appearance is decidedly against it, but, like a singed cat, it is better than it seems. The *Boleti*, of which I am able to identify two varieties, grows here in great abundance in the spring, fall and early winter, and, properly cooked, it is a desirable addition to the table. It is meaty, solid, grows in profusion and a few minutes' picking soon fills a basket with an article of food that is nearly equivalent to the same amount of beefsteak.

All the species described before were *Agarics*, or fungi, whose under surface were "gill-bearing." In the *Boleti* the spore-bearing surface underlying the cap, in place of gills, is a spongy mass of minute tubes. Almost, if not all, varieties of the *Boleti* are now known to be edible.

Boletus edulis (edible *Boletus*).—This mushroom is largely used in Europe and is much sought after by Italians and others here. Pileus: cushion-like, moist, variable in color, light brown to darker, brownish red. Surface: smooth, but dull; diameter at full expansion, three to six or eight inches. Tube surface: whitish in very young specimens, at length becoming yellow and yellowish-green. Pore openings: angled. Spores: ochre colored. Stem: stout, often disproportionately elongated; pale brown, generally with a fine, raised network of pink lines near junction of cap. Flesh: white or yellowish, not changing color on fracture. Taste: agreeable and nutty, especially when young. Habitat: woods.

Boletus subtomentosus, or yellow-cracked *Boletus*.—Pileus: diameter, three to six inches, color varying in different individuals, yellowish brown, olive or subdued tan color; epidermis, soft and dry, with a fine pubescence. Cracks in surface become yellow. Flesh: creamy white, in mature specimens, changing to blue, and at length leaden or fracture. Tube surface: yellow or yellowish green, becoming bluish when bruised; opening of tubes large and angled. Stem: stout, yellowish, minutely roughened with scurfy dots or faintly striped with brown. Spores: brownish ochre. Taste: sweet and agreeable. Habitat: woods. Season: summer and autumn.

I have found two other varieties of the *Boleti*, besides those described, one of which is edible and wholesome, as I have the evidence of myself and others to know; but I am unable to identify it with any description

which I have yet found. A fourth variety I have found growing in the dense woods along the Columbia river, near the point of interest known as Rooster rock. This *Boletus*, of which I found a number of specimens, may, like the one just mentioned, be a modification of some well-known variety, altered in character from local conditions of habitat. At any rate, it presented a forbidding and formidable appearance, being of a dingy and ashy black color, both without and within, and was altogether the most unlikely looking specimen of vegetation with which I have ever met. I am cognizant of the fact that there is a species of *Boleti*, known as *Boletus satanus*, which has been eaten by Captain McIlvaine, who pronounces it "the best of them all," and these may have been exaggerated specimens of that variety. Be that as it may, it was evil to look upon, and had the odor of mold from dead men's graves, and I restrained myself from eating a mess of them.

Cevaria, or coral fungus.—Growing in the woods, one at times will find a cluster of this fungus, which is pale gray, white or yellow in color, owing to the different varieties, and has the appearance of a spangled bunch of cauliflower. It is succulent, and looks as if water soaked. Its stem is thick and hollow, and it is edible.

Morchella esculenta, or the *Morel*.—Anyone who has ever seen a *Morel* will forever after be able to identify it. It is one of the best varieties of edible fungi, and is extensively used as a delicacy in Europe. It grows quite plentifully in Oregon in old orchards. Pileus, or cap: oval; elliptical or round in outline; diameter, one inch to three inches in a large specimen, hollow. Color: pale, yellowish brown, varying to greenish (in old specimens almost black). Surface: more or less honeycombed, with deep depressions. Stem: hollow, dingy white, united to base of pileus. Taste: sweet and pleasant. Season in Oregon: autumn and early winter.

Helvella crispa, or *Helvella*.—Only a few times have I met with this variety growing in the woods. With its thin, wavy and peculiarly contorted cap, and the striking border produced by the contrast of the brown of its under surface, where upcurled against the upper creamy covering of the cap, with its deeply indented and pitted stem, it is the vegetable gnome of the woods. It is the relation to the *Morel*, and similar in taste. Gibson describes it as follows: "*Helvella crispa*, or the white *Helvella*: Pileus or cap, two or three inches in diameter, wavy or curled, reflexed at edges, often puckered toward center; white or pale creamy; somewhat leathery in texture in older specimens. Spores: surface, on under side of cap, ochraceous. Stem: white, more or less furrowed, with vertical hollows. Taste: similar to *Morel*, to which it is closely allied. Habitat: woods. Season: summer and autumn."

Lycopedacia, or puff-balls.—In its early growth, while the flesh is young and white, the puff-ball is esteemed a delicacy by many. The best variety

of this species, the giant puff-ball, growing in size to be as large as a football at times, is said to be found near the Columbia river, in the neighborhood of St. Helens. They should be used only while the flesh is in its white and sound state. Caution, ordinary prudence and common sense must be consulted before using any strange variety of mushroom. Carefully compare such specimens with the printed descriptions and check off the points one by one; by so doing the better-known kinds soon come to be easily identified. Spore prints are easily obtained by placing the fungus with the spore-bearing surface downward upon a sheet of paper and inverting a bowl over them, using white paper for such as bear dark colored and dark paper for those which bear white spores. They should be laid upon a smooth, flat surface, as the slightest breath of air will mar the resulting print. Leave them thus placed for a few hours, or over night, and the beautiful tracery will amply repay you for your trouble.

Since writing the above, I have identified a poisonous variety of the *Russulas*, namely, the *Russula emetica*. This handsome variety, growing in the woods, with its bright red cap, peppery taste and emetic properties, will be more fully described in a later note to this article.

In closing an article upon mushrooms I stated that I had identified a poisonous variety of the *Russulas*, which I would more fully describe. This I will now proceed to do:—

Russula emetica, or poisonous *Russula*.—In a note to his description of this species, W. Hamilton Gibson says that "while for conservative reasons, the poisonous reputation of this species is here perpetuated, it is quite probable that such condemnation is unwarranted as to the raw mushroom." The peppery tang and demoralizing powers are now claimed to be dissipated in cooking — thus bringing the entire genus *Russula* into the friendly group. Capt. Charles McIlvaine is largely responsible for this conversion, his individual experiments having warranted him in pronouncing this species "as good as the rest when cooked." "The *Russula emetica*, as its name implies, is at war with luxurious gastronomy, but its distinction, after all, is quite simple. The amateur should hardly rely upon the botanical characters alone. He should test every specimen of his *Russula*, of whatever kind, before venturing upon its use as a food." In taste it is hot and peppery, in its raw state. Such are the friendly words of warning of Gibson. As a matter of fact, I did not find a specimen of the *Russula emetica* of such well-marked characteristics as to enable me to properly classify it, until, alas, I had devoured large numbers of them upon divers occasions, indiscriminately served up with more peaceful varieties. Personally, I have no fault to find with them, and I would be ungrateful to the inanimate beauties if I failed to acknowledge that I found them to be exceedingly good. Having likewise tried them upon many friends, one being a well-known United States district judge, I am prepared to prove that they are harmless in Ore-

gon. The description from Gibson for this species is as follows: Pileus, or cap expansion, two to four inches. Color: varying from pale, bright pink to deep scarlet; very smooth. Gills: broad (in section), mostly equal in length, and continuous from edge of cap to stem; not crowded; white. Stem: white or pinkish. Spores: white, like all *Russula*. Habitat: woods, with other *Russula*. Taste: hot and peppery. Season: in Oregon, spring, autumn and early winter.

Variations.—Like some nuts and berries, notably the hazelnut, and such berries as the whortleberry, there seems to be considerable variation in mushrooms as they grow here, and the same species as they grow in the eastern states, as but few of them tally exactly with the description of the authorities, but vary in some species to a degree that is puzzling at times. As an instance, I now find four apparently distinct varieties of edible *Boleti*, three of which grow in lowland thickets of pine and oak timber, and one in highland fir woods, none of which will answer to certain points of scientific description, and fail to give others, which are then found to exist in another specimen, which in no other detail answers to the descriptions given to any. Several other varieties of *Boleti*, of various uncouth forms and unpleasant colors, varying from a dark, brownish red to a sullen black, are to be found, which I so far fail to classify. Captain McIlvaine says that all species of the *Boleti* are edible; it may be true, but I have not that faith yet in the doughty captain which he perhaps is entitled to, having in mind, too, that the small boy defined faith to be "a believing in somepin wot you know ain't true"; so I place such specimens upon their backs upon such logs and stumps as are convenient, and leave them for the captain, should he chance that way. I so far have not even had the heart to try them upon my friend, the judge. The same variations found in the *Boleti* have puzzled me in an honest endeavor to make out whether a certain large, dark yellow mushroom, quite common hereabout, is one of the *Lactarii*, or milky mushrooms, or whether, mayhap, it is a chantarelle; for if it is a milky mushroom, it has gone dry in this climate, and has no milk; and if it is a chantarelle, it has well-marked, deep gills, where it should have but rudimentary ones. There are, perhaps, more variations in the common meadow mushroom, *Agaricus campestris*, than any other species. In some specimens the cap will be smoother, darker in color, with delicate stripes running from the summit downward; the gills are a lighter pink, and in some specimens have a pale and washed-out appearance, in young specimens, which as they grow older grow more dingy and dark in color than does the more common meadow mushroom. In other specimens the cap will be more shaggy, and the gill surface a deeper red than the *Agaricus campestris*. These and many more variations, too numerous to mention, are to be noted in specimens growing outside of the regular range of the ordinary meadow mushroom, as in glades of woods, along the borders of old

roads, among the ferns in old slashings, and other places. All of these varieties are edible, but some of them have a flat, metallic taste, both raw and when cooked, which is not pleasing.

Popular tests for edible mushrooms.—As there are many foolish tests upon which to found an authoritative opinion as to the edibility of mushrooms, I can do no better than to copy a list of such from Gibson's work. Among the favorable signs upon which reliance is placed by many are—

1. Pleasant taste and odor. (The poisonous *Fly Agaric* has no unpleasant odor, and is as sweet as a nut.)

2. Peeling off the skin of the cap from rim to center. (I formerly had great faith in this one myself.)

3. Pink gills, turning brown in older specimens.

4. The stem easily pulled out of the cap, and inserted in it like a parasol handle.

5. Solid stem.

6. Must be gathered in the morning.

7. Any fungus, having a pleasant taste and odor, being found similarly agreeable after being plainly broiled without the least seasoning.

Supposed unfavorable signs:—

8. Boiling with a "silver spoon," the discoloration of the spoon indicating danger.

9. Change of color in the fracture of the fresh mushroom.

10. Slimy or sticky on the top.

11. Having the stems at their sides.

12. Growing in clusters.

13. Found in damp, dark places. (I have not entirely recovered from this one myself.)

14. Growing on wood, or decayed logs or stumps.

15. Growing on or near manure.

16. Having bright colors.

17. Containing milky juice.

18. Having the gill plates of even length.

19. Melting into black fluid.

20. Biting the tongue, or having a bitter or nauseating taste.

21. Changing color by immersion in salt water, or upon being dusted with salt.

Gibson says that "taken *in toto*, these tests would prove entirely safe, as they would practically exclude every species of mushroom or toadstool that grows." How then shall we distinguish a mushroom from a toadstool? There is no way of distinguishing them, for they are the same. There can be no general rule laid down for the discrimination of an edible fungus. Each must be learned as a species, or at least familiarized as a kind, even as we learn to recognize certain flowers, trees or birds.

I am asked to give directions for growing mushrooms, and as I have had no experience in their cultivation, and as the method is one requiring great care and close attention to details and would lengthen out this article beyond endurance, I am compelled to refer all those interested to the work entitled "Gardening for Profit," by Peter Henderson, wherein will be found all the information required. I wish to state, however, that but one species, namely, the common meadow mushroom, lends itself to cultivation, all other species which have been tried having obstinately refused to grow, even when the spores or spawn have been planted under such apparently indentical conditions of soil and other requirements as could be found within a space not farther removed than a short twelve inches from the mother specimen.

SCALE PROBLEM.

By Prof. C. W. Woodsworth.

In most of the discussions of the San Jose scale attention has been chiefly directed to the means of preventing its spread into unaffected areas, and to the possibility of eradicating the pest where it has already gained a footing. These have been the questions of most immediate concern throughout the eastern states, where even yet in the greater portion of their area it is still only dreaded, but not yet experienced. The time will come, has come in many places, when the problems are no longer these, but are concerned with the means of controlling an insect already so firmly established as to defy eradication, and which must be reckoned among the problems to be considered in the production of each crop of fruit. The problems are not by any means beyond the powers of the intelligent fruit-growers, but they will require their most intelligent consideration, for the statement that this is the most serious menace that has ever appeared in the orchards of the eastern states seems to be entirely justified by the facts.

California experience.—Between fifteen and twenty years ago the orchards of California passed through the experience which is now before those of the eastern states. With us all methods of extermination have failed, and the insect has long been thoroughly established all over the state. Spraying remains an important matter in its control, but is nowhere regarded as capable of exterminating the insect. By exercising great care our nurserymen are able to grow stock for the most part entirely free from scale insects of all kinds—indeed, finer and cleaner nursery stock is not produced in the world. Young orchards often remain for sometime also quite free from these pests. Sooner or later, however, the orchard usually becomes infested, but so well is the matter in control, that in the hands of careful orchardists, there is no preceptible diminution in productiveness when this occurs. This statement will doubtless equally apply to the conditions in the eastern states, after the insects shall have become established and the problems of its control solved.

How the scale injures a plant.—The nature of scale injury, as most are aware, consists in the insertion of the long, delicate proboscis of the insect through the drier portions of the bark into the softer tissues underneath, and the withdrawal of the water and of other substances found therein,

resulting in the death of these cells. The injury of one insect does not amount to much, but the combined work of a great number produces very serious results, effecting sometimes the immediate death of considerable portions or even of the whole tree. The sudden death, however, of the whole tree, or of the larger branches, is not the usual result of the attack of the scale, at least after it has become well established in a region, but instead, there is a gradual death, a condition equally fatal to the hopes of the orchardist. In general, it may be said that the effect of scale attack is somewhat similar to that of a severe drought, and when these two affect the tree conjointly the effect of each is exaggerated and the maximum injury results. Four elements of this injury may be noted:—

First.—The direct injury to the inner bark by the proboscis causing its death, resulting in an abnormal thickening of the hard, dry portion. The immediate death of the tree, or of a portion of the plant, is always due to the destruction of all the layer of soft tissue beneath the bark, when death ensues from the same causes as when the tree is girdled. The more usual attack leaves enough live tissue beneath the bark to continue the normal growth of the part, but for the thickness and hardness of the bark, which mechanically prevents the growth of the usual ring of new wood, and the plant is then said to be barkbound. As every orchardist knows, such a tree ceases to grow; has a great tendency to over-production of fruit of poor quality; becomes worse and worse each year, and is no longer profitable.

Second.—The withdrawal of water from the plant, at the time when it can least afford it, often causes a premature ripening and dropping of the leaves. The leaves are the factories in which are produced the substances used in the growth of all parts of the plants, so that the loss of the leaves results in a stoppage of growth. The most important item of growth, which is thus prevented in the fall, is the growth of the new, fine rootlets, upon which the next season's water supply, in a great measure, depends. A tree becomes thus, year by year, weaker and less productive.

Third.—The injury to the crop of the present season, resulting in the production of distorted, scaly fruit, or of that which is stunted and small. When scales are present in excessive numbers, the young usually attack the fruit as well as the branches, producing the results indicated. This can only be prevented by the use of sprays sufficient to keep the insect down to a point where this habit is not pronounced. The stunting of the fruit is produced in the same way as the effect in the leaves mentioned above. While the injury to the fruit gives the greatest immediate loss, there is no permanent injury from this cause, as far as the tree is concerned.

Fourth.—The injury to the roots, following as the result of injuries to the bark and leaves, is the easiest overlooked, and, therefore, likely to be

the most injurious of the elements of injury here mentioned. The injury to the bark, by preventing the new wood growth, impedes the downward movement of food materials towards the roots, and the injury to the leaves decreasing and finally stopping its production. No growth of the roots can occur unless the food material is first manufactured in the leaves and then passed down the branches along the young, softer tissue beneath the bark, where alone it can pass freely. A vigorous root-growth is necessary for a satisfactory top-growth or production of the next season.

The means of preventing scale injury include, as the most important, those methods of horticultural practice which are calculated to obtain the best condition of growth, and to counteract the injurious effects of the scale.

Keep the bark healthy.—The bark must be well attended to. A strong growth should be maintained each season by cultivation, judicious pruning and fertilizing when needful. The gashing or scraping of the bark of the trunk or larger branches, when they become too hard, or, better still, the use of a caustic wash, like our lime, salt and sulphur mixture, becomes, with the presence of these scales, a process of great importance. This mixture is very extensively and regularly used in California, where the climate is particularly liable to produce the bark-bound condition, even without the work of the scale insects, and is often found very profitable on trees absolutely free from the pests.

Pruning.—Pruning must be more thoroughly done. The top should not be allowed to become too large for the roots. It should make a strong growth every year, and be well covered with foliage, and be able to hold these leaves throughout the season. The amount and character of the growth of the top depends almost entirely on the water supply. With a proper pruning the top can be reduced to a point where the roots will become abundantly able to produce these results. Eastern growers may not find it useful to cut back to the extent practiced in California, but most of them have much to learn of the value of the pruning knife in orchard culture. The presence of scale insects, or anything resulting in premature dropping of the leaves in the fall, would indicate the need of more than usually severe pruning.

Cultivation.—Summer cultivation is necessary to conserve the moisture in the ground during the dry spells of summer. The thorough pulverizing of the upper soil will often enable trees to pass a drought unharmed, which otherwise would suffer severely. With the presence of scale insects, this becomes doubly important. Drought is twice as dangerous to a scaly tree as to one without scales.

Moisture supply.—Irrigation should be adopted where practical, for with water intelligently applied trees need never suffer from drought, and the problem of defense against scale injury becomes wonderfully simplified.

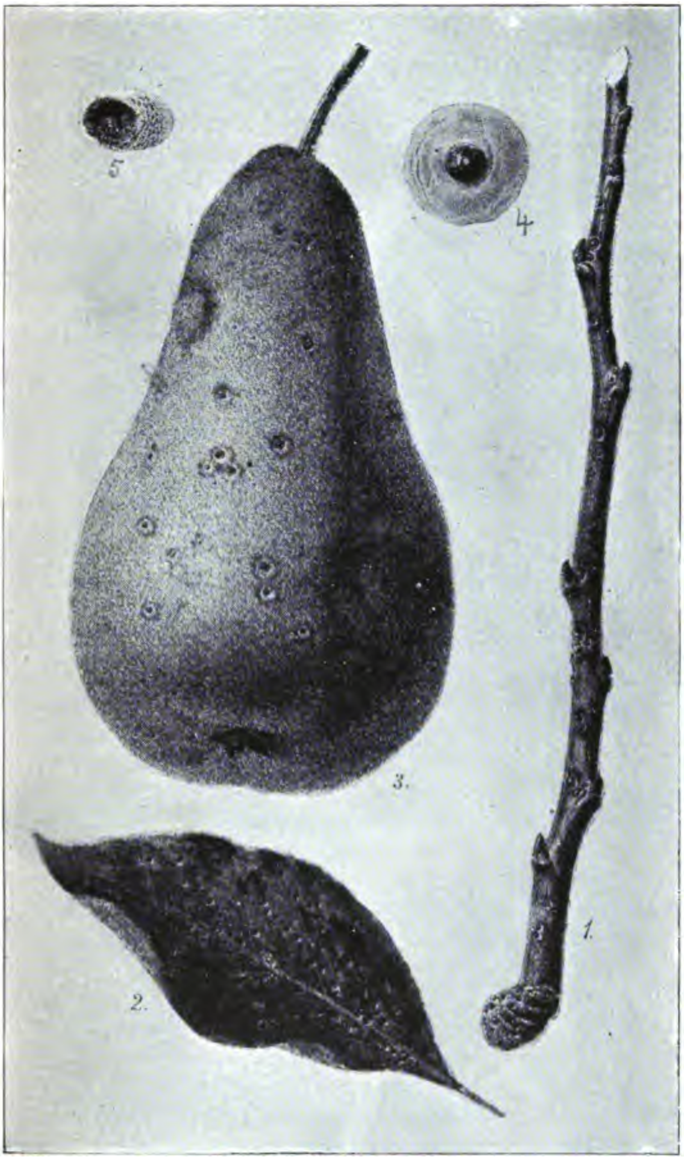
In California, where irrigation is practiced, the system is to apply water when needed, to keep the bark soft by winter spraying, and to spray for the scale when they become too abundant and threaten to invade the fruit. Where irrigation is not practiced, the orchardists are still able to avoid the loss by more careful attention to the other points herein discussed.

Watch and study.—Finally, watch the insect and be ready to spray when it becomes too abundant, for at times it will so increase as to appear in overwhelming numbers and loss can only be prevented by treatment. This will, for some time, be a more important matter in the east than in California, as the insect has not yet found its level.

The remedies to be applied need not be discussed here, as that will doubtless be thoroughly done by others. It will be sufficient to say that our experience is that no spray is effectual in eradicating the insect, but that when they are abundant it is possible to greatly reduce their numbers, so that, with the other means that have been discussed above, injury can be avoided, and that usually several years intervene between the periods of excessive numbers.

Success will be dependent on the judgment of the orchardist. No set of rules can be laid down to be blindly followed. A clear appreciation of the problem and the exercise of the same careful judgment that is necessary in handling the other problems of fruit-growing will, without doubt, leave the eastern grower, as it has the California orchardist, master of the situation.

NOTE.—Spraying trees with spray No. 1, or sulphur, lime and salt, as laid down in the sprays of this report, has resulted in entirely eradicating San Jose scale on all trees sprayed in eastern and western Oregon; and spray No. 2, or sulphur, lime and blue vitriol, produced like results in southern Oregon — see page 183 — DOSCH.



THE SAN JOSE SCALE.

1, Infested branch; 2, Infested leaf; 3, pear, bearing a few of the scales; 4, female scale—enlarged; 5, male scale—enlarged.

THE ROOT-KNOT PROBLEM.

By PROF. A. D. SELBY, botanist, Ohio experiment station.

Seriousness of the evil.—Is there a real problem for fruit-growers in the occurrence of enlargements or tumors upon the roots or crown of the plant and less commonly upon the trunk at some distance above the soil line? Do their occurrence menace the life and productiveness of the plant bearing them? And, if so, is their danger of increased spread of the conditions? To all these questions I think we may give an affirmative answer. Furthermore, the problem affects wide areas, although having somewhat variable conditions.

CHARACTER AND OCCURRENCE.

The growths in question are morbid and tumor-like in nature; they are composed, for the most part, of soft, corky or spongy tissue, such as might be expected from the continuous operation of some irritant upon the living parts of the plant under ground. In nearly all cases they are newly formed with each season's growth, dropping loose and decaying while the next ones are being developed. This condition certainly holds for the peach and raspberry galls growing under ground, though less certainly for those of apple and pear. Upon the plum they more nearly resemble those of the peach. Enlargements of this indicated character are known to occur in Ohio upon raspberry and blackberry plants, upon peach, plum, pear and apple trees and upon Carolina poplar. Elsewhere, notably upon the Pacific slope, they are reported upon grapes and roses. We may look for them upon some other trees and shrubs. They are already common upon pear stocks from Europe and on plum stocks from Georgia. Upon blackberries and raspberries the galls are much alike, while the tumors on pear roots are similar to those upon the peach. Very similar growths occur upon the roots of the herbaceous *Begonia rubra.*

The texture of the enlargements changes greatly in drying, but when examined in a fresh state they are commonly soft. In the peach they are found as stated, upon the roots, upon the stem at the crown, and with those below are associated similar growths at some distance above the ground. The same condition holds for raspberry plants. There is a distinctive character about the growths which should lead to a prompt recognition when all parts are exposed for examination. The exterior of the gall is rough and

warty, while the transition to healthy tissue is sudden and abrupt. Such a gall 1 inch in diameter may occur upon a small root, while I have seen one 8 to 10 inches in diameter upon a poplar 2 to 3 inches in diameter. My examinations have chiefly been made upon young trees.

Names.—The terms crown gall and root gall, with other names, have been applied to these growths; crown gall is, perhaps at present, the least misleading of all that are much used, the only serious objection being the quite general use of the term "gall" to designate a growth about an insect egg or larva. In this paper it is intended to mean an enlargement due to morbid growth, without implying an insect origin. Tumor may have some advantage as a name over that of gall, but I think under present usage we may employ the name root gall or crown gall with little risk. It was Woodworth who suggested "crown gall" as a suitable name for the trouble, in order to distinguish it from the small nematode galls usually called root galls. On the Pacific slope nurserymen formerly spoke of this disease as blackknot. As before stated, the growths are limited to neither root nor crown.

CAUSE OF ROOT AND CROWN GALLS.

The cause of these galls, for the class in general, is yet an open question. Commonly, as stated, the galls are newly formed each year, and we may find both old and new ones upon an affected peach tree, the old dead or decaying, the new fresh and growing. Moreover, when galls are evident only upon a small root, the removal of the root and gall does not appear to dispose of the trouble. The galls follow upon the crown or other roots. Excision and sterilization of the wound with sulphur has not prevented the reappearance of the galls upon several affected trees which were treated. Dr. E. P. Smith has suggested that some organism irritating the tree at the point of gall growth might account for the disease, and that animal organisms should be sought for. Woodworth and Toumey support the parasitic and contagious nature of the trouble. So far as known to me, microscopic or culture examinations have been without definite results in discovering a constant parasitic fungus or bacterium in fresh galls. None has been shown in the several plates made by the writer or in the many examinations of sections and the like.

Occurrence of nematodes.—Eelworms referred to species of *Heterodera* occur in raspberry galls like those found especially on Thompson Prolific. They are present in such numbers and with such constancy as to suggest a casual relation. Certain eelworms or nematodes, to be sure, are found in decaying vegetable matter, but in this case just cited they were in the youngest galls below the ground. Hard, stem galls above the ground on some of the same plants showed no organisms. The nematodes may apparently be one of the causes of the galls, at least on the raspberry. The

apparent greater frequency of such root galls upon peach trees, and perhaps other sorts grown in the milder climates, seems likewise to support the same suggestion as to their origin. I have recently met with an interesting case in a few nursery rows raised in a grower's berry patch in Ottawa county, Ohio. In one or two of these rows, lying somewhat low and in dark, black soil, a large per cent. of the trees were thus affected the next June after budding. These trees were all orchard volunteers transplanted while very young. But in the part of the rows where the disease prevailed worst an excessive application of dried, lumpy, cow manure had been made about three years before. An excess of partly decomposed organic matter was found about these roots. Nematodes were abundant in the exterior gall tissues and apparently in the newer part of the new galls; as to the latter point it was difficult to determine. I have specimens of these.

An experiment.— Healthy peach trees were planted, by the owner's permission, in a raspberry plat at Berlin Heights, Ohio, suffering from nematode root galls. At the end of 13 months after transplanting 20 per cent. or more of these surviving peach trees were similarly affected with what is not manifestly different from the root and crown galls found upon other affected peach trees. With the lot of peach trees exhibited a raspberry plant was found affected in like manner. The evidence given indicates some casual relation between the nematodes and the root galls. The disease has been communicated in one or two cases from affected or apparently healthy peach trees transplanted to fresh land at a distance of about eight inches from each other.

How we can harmonize this hypothesis or inferred cause with other observed conditions I am not prepared to state. The formation of the stem galls at the same time and on the same plant presents a difficulty. The existence of a gall-forming tendency in the tissues of the plant, as of the peach after the excision of a small affected root or the removal of a medium sized gall at the crown, would scarcely be supported by the naked nematode hopothesis of cause. Yet the larger part of the foregoing statements require the existence of a parasitic, or at least some external organic cause or causes. I shall not be surprised should we learn in time that there are two or more causes working conjointly.

EFFECT OF THE DISEASE UPON THE TREES.

The trees affected with root gall trouble seem fatally diseased, and several years' observation seem to warrant the conclusion that any peach tree or raspberry plant so affected at transplanting age will not come to successful fruiting. I have at hand a letter from a Georgia nurseryman and fruit-grower, who asserts in it that nine tenths of Georgia peach trees of bearing age in his region (South-Middle Georgia) are to some extent affected with it. However the trees may survive it in other states, Ohio peach trees conform

to the statement first made, and do not come to bearing nor continue fruiting when suffering from root or crown galls. The disease communicates itself to surrounding trees in close proximity. Whatever be the sufficiency of any hypothesis as to the cause of crown gall, the effects of it are sufficiently injurious to place the trouble in the foremost rank among plant diseases. It is now working much more havoc among us than peach yellows, and to me it appears the most menacing of all the pests and diseases now threatening the fruit-grower. I believe it will settle the question of raspberry and blackberry planting among orchard trees and change other common practices.

The crown gall seems to originate commonly in the nursery rows, and its effects are transplanted in the orchard. I know of one lot of 1,500 peach trees in Ohio, transplanted in 1895, of which, to the best of my judgment, 50 per cent. are either dead or hopelessly diseased with the galls. The responsibility rests with the trees we may say, but not recognizing them as responsible beings, shall we not have to take the grower and seller as the responsible parties? I believe that we must do so.

WHAT OF AFFECTED NURSERY TREES?

Since the nursery tree is the chief, if not the only factor in the infection of a new orchard or of new land, the purchaser of trees and plants must protect himself in buying them. For Ohio there is apparently good evidence that trees affected with root or crown gall at transplanting will never bear a good crop of fruit. Not this alone, but the communication of the trouble to peach trees from raspberries, and other cases of a communicable nature just cited, would lead us to fear its introduction into orchards or into orchard lands. In my judgment, therefore, nursery stock affected with root or crown gall is worse than valueless to the purchaser; it is both an immediate and a prospective injury and damage. Such stock, whatever be its sort and variety, should not be placed upon the market. It is unworthy of valuation as an article of commerce. Furthermore, a person who buys it is wronged. Stock affected in this manner should be denounced.

WHAT IS AFFECTED NURSERY STOCK?

We may safely say that all stock having the galls upon the root or stem is affected. There are a good many evidences of the existence of disease in trees grown in proximity to trees having such galls. The limit of infection is difficult to prove, but the deciding evidence of such infection, in a given group of trees, can be determined by a blind man. By this is meant the determination of the presence of excrescences upon the roots and crown at digging. Certainly it is possible to know, if one wishes, of the presence of crown gall in a block of trees, when tested by the existence of these excrescences. For a tree-grower or tree-dealer to claim ignorance of the existence

in such trees as I have been offered for delivery, with from 4 to 8 per cent. of them having conspicuous crown galls, is to acknowledge that he has not examined the trees. We must have reform through some channel or the Ohio grower will not long continue to purchase trees.

HOW TO SOLVE THE PROBLEM.

I have already indicated the solution, as it seems to me, of the commercial problem of crown gall: It is to let no affected trees go upon the market. There may be better methods of securing this result than the one proposed, but, if so, they have not presented themselves. I know that our fruit-growers will, most of them, have this well in view when buying trees. The trees must be free from disease upon delivery. I have been trying to determine where certain diseased peach trees that have been planted in Ohio were grown, but have not succeeded, after a goodly amount of earnest effort. I leave that sort of tracing to some one who finds it more interesting and profitable than I have found it. But it seems clearly necessary to denounce such affected trees whenever and wherever the question is raised and that is the course determined upon for a time.

THE LEGUMES AS WINTER COVER CROPS FOR ORCHARDS.

By Dr. James Withycombe.

The Pacific northwest is destined in the near future to become a large fruit-growing region.

Our recently acquired possessions in the Pacific will beget increased commercial relations with the orient, and among the many American products that will eventually find a market in these countries with their teeming millions of consumers, will be our fruits.

The orchardist, in his efforts to meet the requirement of future demands, should carefully consider every phase of fruit-growing, including varieties that are best suited for shipping, desirable soil conditions and the most advantageous methods of conserving the natural elements of fertility for the continuous fruitage and prolongation of the life of the orchard.

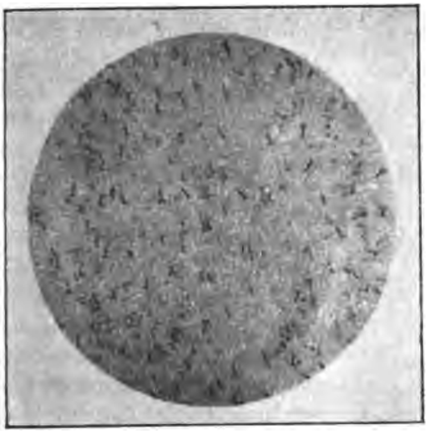
Successful fruit-growers generally agree upon the point of summer cultivation for orchards, and that during this season no supplementary crops should be grown and removed from the land which requires much moisture or potash for their development. The reason for this is obvious, from the fact that a very considerable soil area of Oregon is somewhat deficient in available potash. Hence the fruit-grower should endeavor to conserve this essential and indispensable element of fertility for the growing of the tree and the perfect development of its fruit.

Soil moisture is conserved by cultivation, as the repeated stirring of the soil so disarranges its capillaries that surface evaporation is reduced to the minimum.

Cultivation also brings the land into a suitable physical condition for the development of soil bacteria, especially the nitrifying organisms. Hence, in orchards that are well cultivated, quantities of nitric acid are found.

Through the kindness of Prof. E. F. Pernot, our station bacteriologist, I am enabled to furnish a cut showing these micoro-organisms, as isolated and photographed by him. Nitrogen is always seeking a means for escape, and without some growing plant occupies the ground to retain it during the rainy season this valuable fertilizer will be lost to the husbandman. The legumes are best suited for this purpose, as in addition to the holding of the nitrogen already present in the soil, the growing of

these plants materially increases its nitrogen content, owing to their ability of drawing this element from the inexhaustible supply offered by nature in the atmosphere. The growing of leguminous plants as winter cover crops in orchards not only conserves and increases the percentage of nitrogen in the soil, but it also maintains a desirable physical condition of the soil. The roots of these plants prevents the finely pulverized earth, resulting from the summer cultivation, from becoming too compact; also adds to its humus content, thereby rendering it easy of cultivation and putting it into the most favorable condition for the retention of moisture during the following summer months.



NITRIFYING ORGANISMS MAGNIFIED 2,500 TIMES.

Leguminous plants are known as nitrogen gatherers. This function is performed in the root nodules or galls; here the nitrifying organisms transfers the free nitrogen of the air into forms which can be made use of by the plant. The following are cuts showing these root nodules upon clover and vetch plants grown on the station farm:—

CUT NO. 2—CLOVER.

This peculiar physiological condition found in the roots of the legumes for storing up nitrogen makes these plants of immense value as soil renovators, and it is simply amazing that they are not more generally grown for this purpose. Typical Oregon soils are sufficiently rich in potash for successful growing of ordinary farm crops, but inasmuch as fruit trees require a large amount of potash, it is important that the orchard soil con-

tain a sufficient quantity of this element in a soluble or available form. Potash is found in two forms, soluble and unsoluble, and some soils, although being comparatively rich in this salt, fail to contain a sufficient quantity in an available form, to sustain the needs of fruitbearing trees. And while the legumes do not add potash to the soil, it is a fact, however, that the growing of these plants materially aid in the transformation of the insoluble potash, to a form available for tree and plant growth. *Trifolium pratense* (red clover) is the variety generally recommended for sewing in orchards, and not commonly grown for forage, or for the purpose of green manuring. It is without an equal among the long list of agricultural forage plants when grown as an economical stock food or soil renovator. This plant, however, is not suitable for the purpose of affording a winter cover crop for an orchard, as it requires a full season's growth before it can be of any practical benefit.

CUT NO. 3—VETCH.

The loss of moisture to the trees during the growing and maturing of the clover in the summer season may cause an irreparable injury to the orchard. The amount of moisture required by a clover crop would not affect an orchard planted where the roots of the trees can draw sufficient moisture from an underlying stratum, impregnated with hydrostatic water. This condition is found on river bottoms or other land adjacent to water courses. Unfortunately all of our orchards are not so favorably located. Hence the injurious effects of the growth, during the summer season, of a crop of this clover, would be disastrous to many young orchards.

Trifolium incarnatum (crimson clover) is a variety eminently adapted for the purpose of winter cover crops on many of our soils. This plant flourishes best upon hill land or sandy loams. Being an annual, it develops rapidly in the fall, under favorable conditions, and by the time winter sets in it will have made sufficient growth to cover the ground fairly well.

This clover should be sown in August or early in September. From

fifteen to twenty pounds of seed per acre are required, which should be lightly covered with a harrow.

Upon our heavy clay soils the common vetch (*Vicia sativa*) grows very well and makes an excellent winter cover crop. For best results the vetch should be sown not later than October. The seed is sown most economically with a common grain drill at the rate of one and a half bushels per acre.

These plants, like most of the legumes, are greatly benefited by an application of land plaster. In order to secure an early, vigorous growth in the following spring, it is highly important that this form of lime be used. It should be sown early. February is a good time. Apply from 50 to 100 pounds per acre.

All winter cover crops should be plowed under comparatively early in the spring, while the soil is still in a moist condition.

TILE DRAINAGE.

By Prof. John M. Bloss.

This is a subject in which I am deeply interested, and one in which I feel the people of this valley ought to be greatly interested.

I suppose, from what I have heard from those who came to this country in the early fifties, that a portion of the soil was then in the same mechanical condition as that which now may be seen, where it has neither been cultivated nor tramped by horses and cattle. The soil was then very loose, and old citizens have told me—and I have no doubt about the truth of the statement—that they could push a walking-cane down into the ground two or three feet without any particular effort.

That today you could not do. There has been a change come over the mechanical properties of the soil—a change not due to the climate—the climate is all right—but a change that is due to your methods of treating the soil. You have plowed the soil when it was wet; sometimes the water followed you in the furrow, protesting, as it were, for being disturbed. You expected the rain to continue, but it did not. Then came dry weather, and the sun baked the soil. This has been repeated for years. You also pastured your lands when the ground was wet and soft, and your horses and cattle puddled the whole surface. Thus the mechanical conditions of your soil has been changed since 1850.

I know that imagination has much to do with our ideas of the past. For instance, the hills do not look so high to me in my old home as they once did; the spring is not so far away from the old house as when I carried the water. But making due allowance for all the freaks of imagination, it is doubtless true that your crops were better; that your peach and apple trees grew more thriftily and produced better, and that your wheat and oats made a greater yield then, than now.

It is doubtless true that even in the fifties the soil needed under-drainage; but in consequence of its looseness the water rapidly sank out of sight, and more readily escaped into brooks and rivers. This it can no longer do, because the soil has been baked and puddled until it is in many places almost impervious to water. Hence, if drainage was needed in the fifties, there is that much the more need for it now, and every additional year only adds to this necessity.

As I travel over this valley I see but little land that would not be greatly improved by underdrainage. I have seen none that did not need it. I have no doubt that there may be some such favored spot somewhere in the valley. Let me describe it. It is probably in some river bottom; the surface is from ten to twenty feet above the ordinary stage of water; the surface soil is a sandy loam of considerable depth, resting on a bed of gravel. Here the rain quickly soaks down through the loam and escapes through the gravel. If, however, there is a layer of tough clay between the loam and the gravel, the clay becomes, as it were, a bottom to the bucket and prevents the escape of the water. We call the result a marsh.

PURPOSES OF DRAINAGE.

Let us now see what the purpose of drainage is. It will be the same whether for the prune orchard or the wheat field.

All the products of the horticulturist and the agriculturist are air plants — that is, they grow in the air; the roots as well as the tops must be in the air. Of course, the roots may frequently be bathed in water, but they cannot live for a great length of time in water or under it. The main roots of the wheat will, under favorable circumstances, extend down to a depth of four or five feet; the same is true of timothy and clover. If you have any doubt about this, dig down by the side of a wheat plant two or three feet, then with a hose gently wash away the soil, and you will find what I have stated to be true. The same is true of your prune and apple trees. This can only happen, however, where the conditions are favorable.

The water table is a term used to express the level at which the water stands in the soil. During a portion of the year, the water table in this valley is almost if not at the surface of the soil. In places, it may be a few inches, and in others a foot below the surface. In many of the wheat fields which I have seen along the railroad, the land has been thrown up into narrow ridges, and in the furrows between the ridges the water has been standing practically all winter. The water table in that case would seem to be on a level with the bottom of the ditches between the ridges of land. If you will carefully examine such a field, you will discover that the wheat on the soil farthest above the water table (in the middle of the land) is the most healthful, and that the nearer you approach the water table the more weak and sickly is the plant. There is no accident about this. If you would examine the roots of these plants, you will find that the main roots had been drowned by long continuance in the water, and that the plants are now holding on to life simply by the lateral roots, and that those nearest the water table had but little surface left for lateral roots. These plants show their condition by the yellow color.

That which is true of the wheat plant is equally true of the apple, plum, prune and peach. The roots of these trees cannot live for four, five or six

months under water. To satisfy yourselves of this, examine the rootlets that have pushed themselves down into the soil during the dry season, after they have been immersed for months, and you will find that these rootlets are practically dead, and in many instances that the external covering readily slips from the woody part of the rootlet. Under these conditions, the plant or the tree must necessarily loose its vigor and become diseased, because it has lost the power of resistance.

If you wish to determine the depth of the water-table on your lands, make an opening in the soil 18 inches square and 30 to 40 inches deep. Place the soil removed about the opening so as to prevent the surface water from entering. The depth to the surface of the water in such an opening will be the depth of the water table below the surface, because the water will never rise higher in such an opening than in the neighboring soil. In fact, the water will always be a little higher in the adjacent soil than in this opening. If the land be sandy loam it will be but slightly higher, but in fine clayey soils it may be much higher on account of greater capillary attraction. In properly drained lands the water ought not to stand in such an opening.

Where there is no drainage, and when for a long period the water table lies within a foot of the surface, the roots and rootlets, which during the dry season extend below the water table, are destroyed by the next rainy season. The effect is the same as if these rootlets were cut off at the same depth by shears. Thus the efforts of one season are destroyed before the next begins. Is it surprising that the tree, after a few years of stunted existence, should finally give up the unequal contest and die?

The purpose of underdrainage is to permanently lower the water table to the depth of the tile. If the tiles are placed 40 inches below the surface, then the water table will be 40 inches below the surface, provided the soil is not impervious to water, and the carrying away of the water from the surface, which acts like a roof on your house, will even extend the depth of the water table so that it will be more than 40 inches.

Let us suppose that the proper amount of tile has been placed in the lands, and that these tile are properly laid, what must now take place in order that they thoroughly drain the ground? First, the soil when examined under a microscope, will be found to be made up of separate particles with an interstice between them. These interstices in properly drained soil ought to be filled with air, but in undrained soil they are filled with water. These interstices form, as it were, a series of tubes. In that part of the soil immediately over the tiles referred to above, the water sinks rapidly by gravity to the tile below and is carried away; but as the interstices referred to above are all connected, the water on either side of the drained portion would be forced into this portion by gravity. This would account for the drainage immediately over and near the tile.

I said that the water table would in time be almost on a level with the tile. Let us see for a moment how this is accomplished. If the tile be only partly full of water, then the water on either side of the tile would find itself unsupported on that side, and would find its way into the tile. In this way we should soon observe that little channels were being cut back from the tile on the plane of the water table. At first, these channels would be very short, only a few inches in length, but by constant use these little channels, containing little streamlets, increase in size and gradually extend farther and farther back from the tile.

This affords me an opportunity to express some words of caution. Don't expect too much from your tile the first year. The water *must get into the habit*, as it were, of going into the tile and thus escaping. There must be time given for these little channels to extend laterally away *from* the tile. The first year they may not extend more than five or six feet on either side of the tile, and hence only that much — a strip ten or twelve feet wide — will be drained. The next year these channels will be lengthened, and so the next, so that at the end of the seventh year your tile ought to work better and drain the ground more perfectly than the first year. You will be surprised at the amount of very fine sand that escapes from the outlet of your tile drains. This sand comes from the extention of the little channels which have been cut back from the tile on the water table. This all takes time as was said before, hence you must be patient while the water and gravity are helping you to finish the work of drainage.

It is frequently asked, how does the water get into the tile. Well, it rises up on the underside between the ends of the tile. It could only go down through the top of the tile while the whole is covered with water. The water all goes into the tiles at the ends of the sections. It does not soak through the body of the tile. Avoid the agent who wants to sell you porous tile. You don't want that kind of tile; the harder it is burned the better.

Suppose, now, that you have tiled your lands and removed the permanent water table 40 inches below the surface, and suppose that by so doing you have lowered this water table 30 inches; then you have practically opened up to use 30 inches of soil that before was unused, because until the air could circulate freely through the soil no chemical changes could be made, and no food for plants could have been prepared in it. Hence, when you drain your prune orchards you increase the possibilities for their growth and the old orchard, which has practically used up all the valuable material near the surface, now gets a new lease on life in this new soil.

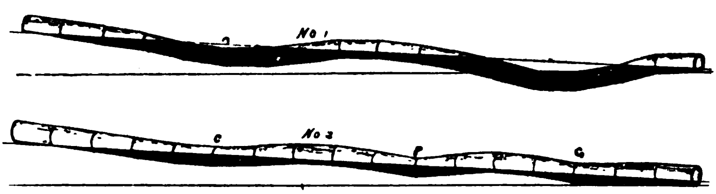
The changed mechanical condition of this permanently drained soil soon begins to show itself. The first year as you plow across the lines of the tile drains, you can readily tell where the drains are located by the lightening of the draft on the team and the friability of the soil. This condition is really more marked in the tough, clayey lands than in black loams. The texture of the clayey particles is finer and the interstices smaller than in

the sandy loam. The clayey soil holds more water than the loam, because the interstices, although smaller, are far more numerous. This, however, only makes the necessity for drainage that much the more important. In the clayey lands the tiles must be closer together than in the loams for reasons indicated above.

It is frequently asked how close must the tile be placed. That question I cannot answer; there is no rule that can be followed. In clayey ground the tile must be closer, say from 16 to 20 feet, while in certain loams equally good drainage may be secured at 40 to 50 feet apart.

The next question which may arise is the size of the tile to be used. This depends, *first*, on the method used in laying the tile; and *second*, on the fall or grade.

First, if the tile is laid by guess or by a water level, or rather by observing the flow of the water in the ditch, then you would better use a six-inch tile where a three-inch tile would be abundant on a perfect grade, because the grade line will have many inequalities in it; and you must make an allowance for the parts below grade to be filled up with silt. If these inequalities, *up and down*, be less than six inches, then some water will continue to flow from a six-inch tile, as in figure No. 2 below.



Figures Nos. 1 and 2 represent tile laid on an imperfect grade. The dark portion represents the silt which has collected in points below the grade line. The light that portion not filled.

In No. 1 the tile is choked with silt at A, and is useless.

In No. 2 the tile is partly filled at C, F and G, and its capacity has been limited to that of the narrowest point, as at F.

The probabilities are that the inequalities will be more than three inches, and that the tile so laid will in a few years be entirely filled with silt, and cease to be of any use, as shown in figure No. 1 above. However great the care taken in laying tile, there are liable to be slight inequalities. These should, however, be reduced to the minimum. Where there are not more than two inches fall in one hundred feet, and where we have nothing better than the eye to determine it, it is very easy to go from two to three inches below the the true grade line without discovering it. This would cause a three-inch tile to be strangulated, and hence useless. If tile are properly laid on a grade of one inch to one hundred feet, it will be sufficient in most soils. Such a grade is over four feet to the mile, which is greater than the fall in many of our rivers. For this reason I would never recommend tile to be laid by a water level. If a man were to offer to furnish the tile and lay

them for nothing, and I had no immediate use for the land, I think that I would let him put them in; but I certainly could not afford to pay for it.

I would have the tile put in on as perfect a grade as possible,—first, because it would cost but little more to do the work, possibly not so much; and second, the tile that I would then need to use would not be more than half the size otherwise needed. The cost of the tile depends on the size. Thus: three-inch, about 18 cents per rod; four-inch, 25 cents per rod; five-inch, 35 cents per rod; six-inch, 50 cents per rod; seven-inch, 70 cents per rod; eight-inch, 90 cents per rod; ten-inch, $1.20 per rod. Now, if a three-inch tile properly laid could be used where a six-inch tile must be used under the other methods, then it would be much cheaper to lay the tile on a perfect grade.

To estimate the size of the tile, the amount of water to be carried away in any one day must be known. A ten-inch tile on a grade of three inches to the hundred feet will carry in 24 hours water to the depth of one inch over an area of 60 acres. The amount of water on the surface of one acre when one inch deep weighs about 112 tons. Hence a ten-inch tile would carry at that grade about 6,720 tons in 24 hours. A three-inch tile would carry on the same grade an equal amount of water from three acres, or 336 tons. But we can rarely ever get a three-inch tile long enough at a grade of three inches to 100 feet to keep itself filled with water for 24 hours. The water can't get to it fast enough. By an experiment which I made, I found that a three-inch tile at a grade of two inches in 100 feet had to be extended to a length of 700 feet before it would run full of water, when the soil was saturated. At a grade of three inches to the 100 feet, it is probable that the tile could be extended to 1,200 feet. If the three-inch tile runs just full of water, then it carries all the water that would be carried by a six-inch tile in the same place, because it carries all the water that can reach a tile at that point. Hence a larger tile would be useless.

When the soil has been properly tiled to the depth of 40 inches, then the water-table, as has been said, has been lowered to almost that depth. The interstices between the particles of the soil are now filled with air, and when the rain comes it readily passes down into the ground, forces the air out and saturates the soil. If one inch of water were to fall in 24 hours, it would saturate the soil to a depth of about 30 inches, and unless the rain fell very suddenly it would all be absorbed. The rain water contains a large amount of carbonic acid gas,—a very necessary plant food,—which is left in the soil, while the water escapes through the little channels on the water-table to the tile drains. Within the next 24 hours this water is carried away and leaves the soil ready for the next water-bath. In the meantime, the air has followed up the water as it passed toward the water-table, carrying with it its heat, imparting it to the soil, and helping, at the same time, to work those chemical changes which stimulate growth.

In addition to the changes in the mechanical condition of the soil, thor-

ough drainage does another important thing: it raises the temperature of the soil during the rainy season,— winter and spring,—and makes the soil more moist during the dry season. These are conditions certainly greatly desired by every farmer.

In underdrained lands, there are but three ways for the water to escape,— first, to pass through the soil and sub-soil; secondly, to flow away over the surface of the soil; and thirdly, to evaporate and escape by means of the air. Only a very small portion of the rain which falls in this valley can escape through the soil and sub-soil. Hence the greater part must escape either by overflow or evaporation.

When your head aches, you bathe your forehead with ether; this quickly evaporates and carries away from your temples the excess of heat. Let it evaporate from your hand, and you feel that your hand is colder. The evaporation of the water from the surface of the soil has the same effect on the soil and the plants—it lowers the temperature of the soil and chills the plants. The rapidity of growth of any plant depends upon moisture and warmth. Properly drained land is, therefore, warmer than the undrained— first, because the amount of evaporation is lessened; and second, that which is just as important, the air circulates through the soil down to the water-table, and gives up to the soil its extra heat.

During the dry season, the air circulates freely through well drained lands, because it is friable; and as the soil is colder than the air it causes a condensation of the moisture in these currents of air which makes the soil moist. All know that the more thoroughly pulverized the soil, the better it withstands drought. By proper drainage 15 days may easily be gained in the spring, and the fall may be extended an equal time. Thus, a month may be gained for maturing various crops.

Someone usually asks during these talks on drainage what about the road? Well, if you will drain your farm and make an Eden of it, you will then have something to make roads for and with. If you will tile drain your roads to the depth of 40 inches,—placing a tile on each side of the roadway,—raising the center of the road so that the water will run off, you will have ordinarily good roads, and especially is this true if you drain the lands on either side of the road. No energetic community need have bad roads in this country, nor does a town or city need to have muddy streets,— don't wait for sewerage, that will come later, but tile-drain your streets and grounds.

METHOD OF LAYING TILE.

In order to properly underdrain your farm there should first be a carefully prepared plan; it would be better to make out a complete map, drawn to some scale, say one inch to the hundred feet. The *first* thing to be secured is a proper outlet; *second*, the position of the mains which are to carry the water away—the size of these must be adapted to the amount of

water to be carried, and *third*, the lateral drains. I would suggest that you stake out these mains and laterals just as you wish the drainage to be when fully completed. Drive a good stake 18 inches long down into the ground until the top is even with the surface of the soil; this is the grade stake. By the side of it drive in a stake 2 feet in length and leave 1 foot exposed; this is the station stake. These stakes should not be more than 25 feet apart. When this is done get an engineer, if you are not one, and have a complete survey made of your lands.

If your plan shows that the laterals are to be 20 feet apart and you are not able to do all the work in one season, then put in the mains and put in lateral drains 80 feet apart; the next year make the laterals 40 feet apart, and the next year put in twice as much tile and make them 20 feet apart. The same grade stakes will remain through that period.

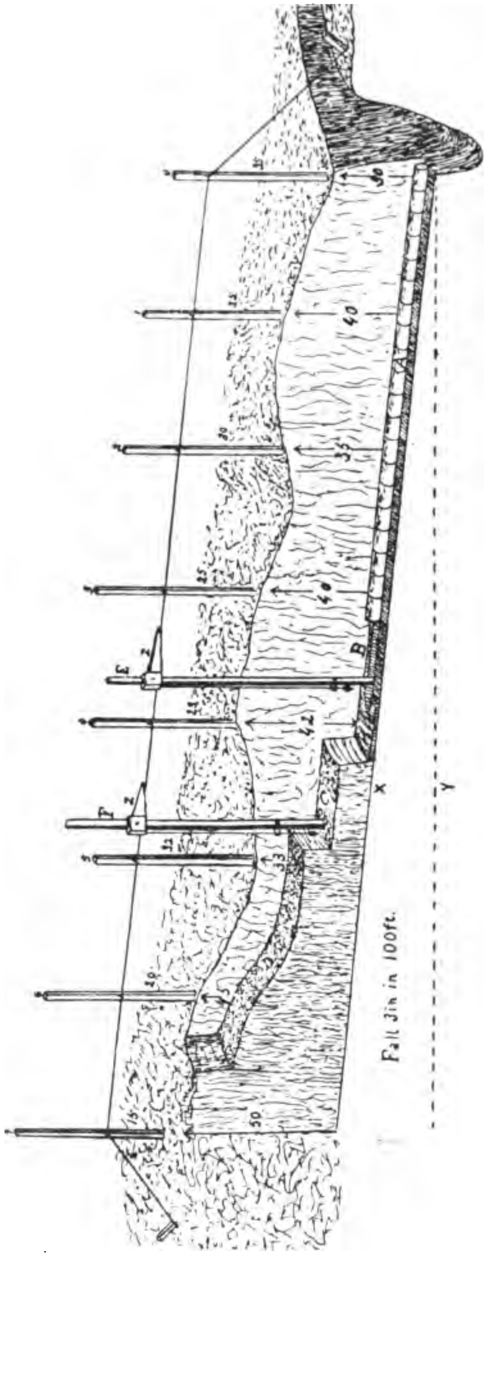
The engineer will give you the depth of the tile at each stake or station, and, if competent, can tell you the size of the tile to be used. This will cost something, but when you have once prepared for the work it will take him but a short time to level and make the calculation for a thousand rods of tile. If this is properly done it will save many times its cost. We speak of houses and farms as being permanent improvements, but really the tile drainage will be the only permanent improvement that you will ever put on your lands. A thousand years hence, if it has been well done, it will still be new. Hence it should be well done.

The following device, illustrated in the cut on the succeeding page, is the best means that I have found for securing a perfect grade in laying tile without an engineer to test the work as it is completed.

Here it will be observed that there are eight stations. The survey shows the depths at each grade stake as follows:—

Station 0	30 inches	Station 4	42 inches
Station 1	40 inches	Station 5	33 inches
Station 2	35 inches	Station 6	45 inches
Station 3	40 inches	Station 7	50 inches

At the side of the gradestake stakes about four feet in length are driven into the ground which have the station marked above them. On the side of these stakes is a hook. The first stake at O is driven into the ground until the hook is just 35 inches above the grade stake. This makes the bottom of the tile just 65 inches below the hook. The second is driven into the ground until the hook is just 25 inches above the grade stake, making the bottom of the tile just 65 inches below the hook. The other stakes, it will be observed, have each been driven into the ground until the hook is just 65 inches above the bottom of the tile. Then a wire (a fine steel wire of the kind used for holding stovepipes in place) is stretched very taut on the ground between the two inclined stakes, and when fastened, it is then lifted into the hooks on the stakes. This wire must be, if the survey is correct, a straight line and parallel with the bottom of the



ditch and just 65 inches above it. This wire is on one side of the ditch, but not over it. In the preceding illustration the line Y is a level or horizontal line, the line X is the grade line and the space between these lines indicates the fall. The difficulty in constructing a ditch for a tile drain, on a grade, may be seen in the accompanying cut. The upright stakes are 25 feet apart, but it will be observed that a different depth is required at each point. The tendency is to make the ditch at all points about the same depth below the surface. In that case the bottom of the ditch would be parallel with the surface. Thus, in the illustration, the first cut, the depth of one spade—about 15 inches—will have a bottom parallel with the surface of the soil as seen at D. The second may be made in the same way, provided it does not reach the grade of the tile. In the illustration the bottom of the second cut at C is placed on a grade parallel with the line X by means of the measure at F. The third cut is made in the same way, but is made so that it lacks about $1\frac{1}{2}$ inches of being to the grade

at which the tile is laid, as indicated in the figure. Then with the bottoming tool or spoon, the bed for the tile is cut out carefully until the grade line is reached. This will be determined by the measure indicated at E. These measures are constructed as follows: The upright piece is six feet long, and $2\frac{1}{2}$x$\frac{5}{8}$ inches; this is laid off in inches; attached to the upright is a movable arm, Z, about 18 inches in length, having a thumb-screw for fastening it at any point on the upright; this arm is fastened at right angles; a plumb is attached to one end of the movable arm. The movable arm in this case is fastened just 65 inches from the bottom of the upright; hence, when the measure is placed vertically on the bottom, if the grade line has been reached, the arm ought to touch the wire. In this way the bottom on which the tile rests may be made a perfect grade and parallel with the wire.

It is important that the tile be placed in soil which has not been disturbed, that the alignment may not be affected by the tile settling. The tile should be laid so that the ends are brought as close together as possible, and so that the tube will be continuous.

By the method above indicated short lines of tile may be laid on a perfect grade without any survey being made, by first determining the depth of the ditch at each end, and then adjusting the wire an equal distance above each and in a straight line between these points. The height of the wire above the surface of the soil is immaterial; but it must be placed parallel with the grade on which the tile is to rest.

Those who are interested in the subject of drainage will find much of interest in works devoted to that subject by such authors as French, Manly, Miles, Kilpart and Warring.

SOME TILLAGE NOTES.

By Prof. E. R. Lake.

The importance of humus in the soil was very forcibly illustrated in our work the past year. Our soil is a rather heavy, clay loam, usually high enough to be well drained on the surface, though in a few places subject to overflow. Generally the whole tract, 160 acres, is a fair average of valley lands, neither bottom nor hill. That it is deficient in humus, or at least that a greater quantity of humus makes it much easier tilled, is evident from our past year's experience with a 25-acre strip on one side of the orchard. We began plowing February 5 and finished June 6. The last plowed was the strip spoken of above. It was coverod with a rank growth of wild mustard. The plants in many instances were three feet high. The object in leaving this particular strip till last was to kill out the mustard by plowing it under at such time as would insure smothering the largest part of the crop before the seeds would ripen. The crop was well turned under and we were congratulating ourselves that a good job had been done, though we knew much of the crop would mature its seed and the crop would still be with us another year to beautify (?) the orchard in early spring. But we were not looking for the good offices of the mustard, and were happily surprised to discover throughout the season that this part of the orchard needed much less tillage than the rest. The soil of this mustard strip remained moist and friable all summer through, and with one third the tillage it presented a more favorable condition for tree growth, as shown by the vigor of the trees, than any other part of the orchard under similar circumstances, save the crop of mustard.

The saving in expense of tillage can fairly be estimated at $75, as we tilled the rest of the orchard the past year. And the best feature of all is the fact that notwithstanding our efforts to kill out the crop, we now have a good stand of mustard which we shall endeavor not to kill out, but to encourage. If this crop will annually reseed itself and give us a bulk of green stuff to plow under, we consider that we have a typical orchard crop for our section, with the exception that it is not a free nitrogen gatherer. It flourishes under these cloudy winter skies, and blossoms freely during December and January rains.

General tillage operations were ended some time in early August. Soon after this date, say August 15, young mustard plants were shooting forth

quite freely, and now, January 10, there are plants, not isolated ones under particularly favorable circumstances, but great numbers of them, with roots 6 inches long and stems 18 inches to 20 inches, and in full blossom. Yet, the bulk of the crop is from 6 inches to 8 inches high, leaves large, shoots vigorous and all parts of the plants presenting a most healthy appearance.

These winter crops, which are to be plowed under in the spring, are a decided advantage to the orchardist in more ways than one. They are collectors of food material that would be, to a great extent, wasted if not taken up in this manner. Our long continued rains carry deep, down into the soil, and away into the streams, large quantities of very valuable mineral matters which, during the presence of active plant life, are gathered up, as it were, and stored in a form to become available later in the season, as food, for those trees and plants that may be under tillage. Thus any crop, winter-grown, to be plowed under may render great service to the orchardist in these two particulars. Yet if some crop having the hardiness and activity of mustard, and possessing, further, the property of using the free nitrogen of the air, could be grown, the ideal orchard crop would be found; and *much* of the speculation now rife as to the future needs of commercial or other fertilizers for our orchards would be allayed. Still, from our past year's experience, we should feel well repaid for plowing under any good crop of succulent plants for its good offices in tillage operations alone, providing the seed of such crop should cost no more than wheat or oats commonly do.

In this connection we may say we have growing both vetches and crimson clover, but from present appearances the mustard will outdo either, in bulk three to one, though with the advent of warm weather in the spring the vetches and clover may make better relative growth. It is possible, also that the time of seeding of the vetches and clover was not as favorable as was that of the mustard. Continued practice alone will settle this point; while in the meantime we favor any winter crop rather than bare soil.

COMMERCIAL FERTILIZERS.

By EDWARD B. VOORHIES, M.A., director of the New Jersey agricultural experiment station, being extracts from "Farmers' Bulletin, No. 44."

THE PURCHASE OF FERTILIZERS.

As a rule, farmers are inclined to purchase fertilizers on the ton basis, without sufficient regard to the content or form of the constituents contained in them. The direct value of a fertilizer is determined by the percentage of nitrogen, phosphoric acid or potash which it contains. Hence, the buying of a fertilizer is virtually the buying of one or more of these constituents. The more concentrated the material or the richer it is in plant food the less will be the expense of handling the constituent desired.

The following are illustrations of the methods by which brands may be made up, the differences that may exist in the content of actual fertilizing constituents, and the causes of variation in ton prices:—

FORMULA NO. 1.

	Pounds.		*Pounds.*	*Per cent.*
Nitrate of soda	500	Furnishing nitrogen	80	4
Boneblack superphosphate	1,100	Furnishing phosphoric acid	180	9
Muriate of potash	400	Furnishing potash	200	10
Total	2,050	Total	460	

FORMULA NO. 2.

	Pounds.		*Pounds.*	*Per cent.*
Nitrate of soda	250	Furnishing nitrogen	40	2
Boneblack superphosphate	1,000	Furnishing phosphoric acid	160	8
Muriate of potash	80	Furnishing potash	40	2
Make-weight	670			
Total	2,000	Total	240	

Formula number one shows a high-grade product, both in respect to quality of plant food and concentration, while number two is high-grade only in respect to quality. In order that the plant food may be contained in one ton, it is necessary to add what is called "make-weight," or a diluent, usually consisting of substances that contain no direct fertilizing value.

"High-grade mixtures cannot be made from low-grade materials. Low-grade mixtures cannot be made from high-grade materials without adding 'make-weight.' The advantages of high-grade products are concentration and high quality of plant food."[1]

It will be observed that formula number one contains nearly twice as much plant food as number two; or in other words, it will require about two tons of a fertilizer made according to formula number two to secure the same total amount of plant food as is contained in one ton of number one. Now, the material in number two other than the actual plant food is of no direct fertilizing value, but the actual cost of the constituents is considerably increased, because the expense of handling, bagging, shipping and selling are just double what they would be for number one.

It has been shown by continued studies at the New Jersey experiment station that the charges of the manufacturers and dealers for mixing, bagging, shipping and other expenses are, on the average, $8.50 per ton; and also that the average manufactured fertilizer contains about three hundred pounds of actual fertilizing constituents per ton. A careful study of the fertilizer trade indicates that these conditions are also practically true for other states in which large quantities of commercial fertilizers are used.

Formula number one would contain four hundred and sixty pounds of actual available fertilizing constituents per ton—one hundred and sixty pounds, or over fifty per cent. more than is contained in the average manufactured brand; that is, a farmer purchasing a brand similar to formula number one would secure in two tons as much plant food as would be contained in three tons of the average manufactured brand. Assuming that the charges per pound of plant food at the factory and that the expense charges are the same in each case, and also that the quality of plant food in one is as good as in the other, the consumer would save $8.50 by purchasing two tons of the former instead of three tons of the latter. In a few states the consumption of fertilizers reaches nearly one hundred thousand tons annually, while in many it ranges from thirty thousand to fifty thousand tons.

Thus is shown the very great saving that may be effected in the matter of the purchase of fertilizers from the standpoint of concentration alone, or in other words, the importance of a definite knowledge of what constitutes value in a fertilizer. This saving may be accomplished, too, without any detriment to the manufacturer, since the difference to him between making high-grade or low-grade goods, in reference to concentration, is largely a matter of unskilled labor. The manufacturers are in the business to cater to the demands of the trade; if consumers are intelligent, high-grade rather than low-grade goods will be provided by the manufacturers. Furthermore, as already indicated, high grade in the matter of concentration means

[1] First Principles of Agriculture, E. B. Voorhees, p. 109.

high grade in quality, for high-grade mixtures cannot be made from low-grade products.

In many cases, too, it is desirable to purchase the unmixed fertilizing materials, either for use singly or to be mixed at home. Here, too, a great saving may be effected — (1) in the cost per pound of the constituents; (2) in freight rates, and (3) in having the mixing performed by the ordinary labor of the farm, at times when it does not interfere with regular outdoor work. The advantages to be derived from this method are, however, fully realized only when it is possible to purchase in large quantities for cash.

As an illustration of the saving that may be effected, it is but necessary to cite the experience of a farmers' organization in New Jersey, which now purchases annually some 500 or 600 tons of unmixed goods. The cost per pound of the ingredients is to them over 40 per cent. less than the average cost to those who buy the average mixture in small quantities "on time" from their local dealers.

It has been shown, too, by the studies of many of the experiment stations of both the east and south that the materials can be evenly mixed on the farm; besides, samples carefully taken show as good a mechanical condition as those made by the leading manufacturers. This method of purchasing also possesses the further advantage of enabling the farmer to apply just the kind and form of ingredient that he has found by experience or experiment to be best adapted to his soil and crop. Besides, he knows positively, particularly in case of the element nitrogen, whether it is in the form of nitrate, ammonia or organic matter, and whether the organic nitrogen is contained in substances that are likely to decay quickly, as blood, cotton-seed meal, etc., or in such insoluble and slow-acting substances as ground leather, horn, etc. In mixtures the kind of organic nitrogenous substances used cannot be definitely shown by a chemical analysis.

CONDITIONS UNDER WHICH FERTILIZERS MAY BE PROFITABLY USED.

With a more or less complete knowledge of the need of artificial supplies of fertilizer, the character, composition and usefulness of the various materials, and the best method of purchase, the practical question arises, Will it pay to use them? Many of our most successful farmers are by their practice answering this question in the affirmative. It is, however, not entirely a question of plant food with them, and one phase of it may be illustrated by the following typical case: Mr. A. applies fertilizer; his crop is doubled or tripled, and a reasonable profit is secured. Mr. B. applies the same amount and kind under similar natural conditions of the soil and receives no benefit. The difference in results is due not to the fertilizer, but to the farmer himself. In one case the natural agencies — sun, air and water — were assisted and enabled to do their maximum work, because care was taken to make the conditions other than the supply of plant food

as perfect as possible, while in the other they were prevented from exercising their full influence, because physical conditions of soil were imperfect, due to careless plowing, seeding, cultivation and cropping.

In other words, the profit from the use of fertilizers is measured to a large degree by the perfection of soil conditions which are entirely within the power of the farmer to control. The production possible from a definite amount of plant food can be secured only when the conditions are such as to permit its proper solution, distribution and retention by the soil.

The fact that fertilizers may now be easily secured and are easily applied has encouraged careless use rather than a thoughtful expenditure of perhaps an equivalent amount of money or energy in the proper preparation of the soil for them. Of course, it does not follow that no returns are secured from plant food applied under unfavorable conditions, but it needs to be emphasized that full returns cannot be obtained under such circumstances either with or without fertilizers. Good plant food is wasted and the profit possible to be derived is largely reduced. Moreover, farming in its strict sense is the conversion of three essential elements into salable products, and therefore the use of plant food must be governed largely by its cost and the kind of crop upon which it is applied.

The very high prices paid by many for fertilizers — though admitedly due to their lack of knowledge concerning what constitutes value in a fertilizer and to irrational methods of buying — renders it impossible to secure a reasonable profit by their unsystematic use upon such staple products as wheat, corn, oats, cotton and tobacco, because these crops absorb relatively large amounts of the manurial constituents, and are at the present time products of relatively low value.

The bushel or pound of crop contains a high content relatively of the fertilizing constituents while the selling price is low, thus leaving but a narrow margin between the cost of the constituent and the price received for it in the product.

The growth of such crops as potatoes, tomatoes, sweet potatoes, forage crops for the dairy, and vegetable crops for the market or cannery by the use of high-priced plant food is more often attended with profit, because they are usually crops of high market value and are proportionately less exhaustive. This does not mean that the former crops shall be abandoned, but rather that our systems of practice shall be changed so as to include in the rotation some high-priced crop to which shall be applied such an abundance of plant food as to insure a yield, limited only by the season and climate, which will, under average conditions of soil and season, yield a profit, besides leaving a residue of plant food for the cereals, grasses or catch crops that follow. These being capable of extracting their mineral food from relatively insoluble sources will yield a large increase of crop without a direct outlay for fertilizers. Farming will thus be more suc-

cessful, because profitable crops are secured, while at the same time fertility is increased.

THE KIND OF FERTILIZER TO USE.

The kind of fertilizer to use should be considered (1) in reference to whether it shall be nitrogenous, phosphatic or potassic in its character, and not to whose brand shall be used; and (2) as to the form in which the fertilizing constituents exist, whether quickly or slowly available. A proper understanding of these points requires that we shall consider briefly the various classes of farm crops and their power of acquiring food.

The cereals, Indian corn excepted (see p. —), and grasses are quite similar in their habits of growth, and may be regarded as a class distinguished by extensive root system and long periods of growth, which enable them to extract the mineral food necessary from relatively insoluble sources, and because of their very rapid development of leaf and stem during a short season just before maturity are unable to make normal growth during this period without an abundance of nitrogen in immediately available forms. This period usually precedes the time of rapid nitrification; hence, on soils of good natural fertility, the application of nitrogen at the right time and in the form of a nitrate results in a largely increased crop. The fact here stated has led certain eminent scientists to regard nitrogen as a dominant or ruling element for this class of plants, and it is true if the limitations are properly understood.

The leguminous crops—clover, peas, beans, vetches, etc.—should also be regarded as a distinct class. They possess powers of acquiring food which, as far as we know now, are not common to any other class of plants. They do not depend altogether upon soil sources for their nitrogen, but draw this element partly from the air, and they make almost ravenous use of the mineral constituents, particularly potash and lime. A knowledge of these facts is not only useful in indicating what kind of manures to use, viz., an abundance of the mineral constituents only, but suggests that the growth of these crops must result in the enrichment of soils in the expensive element, nitrogen, so essential for crops whose exclusive source of supply is the soil.[1]

Root and tuber crops may also be regarded as a class which, because of their habits of growth, are unable to make ready use of the insoluble mineral constituents of the soil, and hence for full development require an abundance of all the fertilizing constituents in readily available forms. Of the three classes of fertilizing constituents, the nitrogen is especially useful for the slow-growing beets and mangles; soluble phosphates are required in abundance for the turnip; and potatoes, white and sweet, respond favorably to liberal dressings of potash; that is, while the fertilizers should contain all three elements, certain of the crops, because of their peculiarities

[1] Farmers' Bulletin, No. 16, of this department.

of growth, require certain of them in greater relative amounts and in immediately available forms.

The object of the growth, too, whether for the immature produce or for the fully developed plant, is a matter worthy of careful consideration. In other words, shall the fertilizing be of such a character as to stimulate and force an unnatural and artificial growth, or such as assists in the natural development of the plant? That the specific function of nitrogenous manures is to encourage and even force leaf development is a fact not disputed by the highest authority; hence their use in stimulating unusual growth is of the greatest importance in growing market garden crops, in order that the tenderness and succulence, which is the measure of quality in most of those products, may be secured.

Fruit trees are slow-growing plants and therefore do not need quick-acting fertilizers as a rule. They appropriate plant food very slowly, and highly soluble manures, such as nitrate of soda, are liable to be washed out of the soil without being utilized. For this reason the use of nitrate of soda is not advised except where the growth of nursery stock is to be forced, or where bearing trees exhibit a lack of luxuriance in foliage. The old and still common practice of fertilizing fruit trees every few years with slowly decomposing manures, such as barnyard manure, leather waste, horn refuse, wool waste, leaf mold, tobacco stems, etc., is thus seen to have more or less of a scientific basis. Frequently, however, it is desirable to stimulate the growth and fruitfulness of the trees, and for this purpose more active fertilizing materials than the above are needed. In selecting and mixing the latter the fact that fruits are "potash feeders" should be taken into consideration. Probably there is no better fertilizer for fruit trees than a mixture of muriate of potash and ground bone (one part of the former to one and one half parts of the latter). A good practice is to apply this mixture to clover or some other leguminous crop which is turned under as a green manure, and in addition, where tobacco stems can be obtained cheaply, to apply these about the trees. Wood ashes or cotton-hull ashes may be substituted for muriate of potash if these products can be obtained at reasonable prices.

The fertilizer requirements of small fruits are similar to those of orchard fruits; but, being, as a rule, more rapid growers they can utilize to advantage heavier applications of soluble fertilizing materials and do not derive the same benefit as orchard fruits from slowly decomposing manures.

In deciding upon the kind of manure to use the character of the soil must, of course, be taken into account. Crops grown on soils poor in decaying vegetable matter (humus) are, as a rule, benefited by applications of nitrogenous manures, while those grown upon soils well supplied with this substance are more benefited by phosphates and potash. Upon heavy soils phosphates are likely to be more beneficial than nitrogen, while the reverse

is the case on light dry soil. All sandy soils are, as a rule, deficient in potash, while clayey soils contain this element in larger quantities.

In this discussion the barest outlines have been drawn. There are many exceptions to the general rules. The farmer, with the general principles well in mind, must use his intelligence in applying them to his conditions.

FERTILIZERS SHOULD BE APPLIED SYSTEMATICALLY.

The suggestions already given lead to another of great importance, viz., that the use of fertilizers should be systematic. In order that this may be accomplished, a definite system of cropping should be adopted and a definite scheme of manuring worked out that shall meet the conditions of crop, season and climate and enable the farmer to utilize to the best advantage home and local supplies of manure. While it is impossible to give more than the merest outline of such methods, the following suggestions are offered: In the first place, in nearly every state or even locality some one system of cropping is better adapted to the conditions than another. It may be the extensive system, which includes large areas, and the crops, grain, cotton, tobacco or sugar cane; or the "intensive system," with smaller areas and crops of quicker growth and higher value. For the former a method of manuring should be adopted which is not too expensive, but which provides for increased crops and gradual gain in fertility. It would be impracticable in extensive farming, for example, to attempt to increase the yield of a wheat crop from twelve to thirty bushels per acre by the addition of fertilizers only, for, as already pointed out, plant food is but one of the conditions of fertility, and if it were practicable from the standpoint of yield, it would be folly from the standpoint of profit.

A study of the following common four-year rotations — Indian corn, potatoes, wheat and hay — will illustrate what is meant by rational and systematic methods of manuring. On soils of medium fertility spread the farm manure during the fall and winter, and after the land is plowed apply broadcast and harrow in, or harrow first and then drill in, four hundred pounds per acre of a mixture made of one hundred pounds each of cottonseed meal, ground bone, acid phosphate and muriate of potash or their equivalent in kind and form of other fertilizing constituents. This mixture would have approximately the following composition: Nitrogen, two and five tenths per cent.; phosphoric acid, ten per cent., and potash twelve and five tenths per cent. If the land has not been previously manured, or if it is of a light, sandy character, the proportion of nitrogenous matter should be increased and the application be heavier, say, from six hundred to eight hundred pounds.

Corn makes its most rapid growth and development during the hot season, which is very favorable for rapid decay and consequent nitrification of organic substances in the soil. The nitrogenous manures, therefore, may be less in amount than for crops which develop rapidly earlier in the season and for the same reason may consist of organic forms. The mineral con-

stituents, particularly the phosphates, which the crop acquires less rapidly, because of its comparatively short season of growth, are applied in such forms and in such amounts as to provide for a largely increased crop, even though the seasonal conditions are not perfect.

For the potatoes, as a minimum application, six hundred and fifty pounds per acre of the following mixture may be used :—

FERTILIZER FOR POTATOES.

	Pounds.
Nitrate of soda	50
Cotton-seed meal	150
Ground bone	100
Acid phosphate	200
Muriate or sulphate of potash	150

This mixture contains—nitrogen, three per cent.; phosphoric acid, eight per cent., and potash twelve per cent. In this application we are guided by certain other well-defined principles, chief of which are: this is usually the money crop of the rotation; we can therefore afford a more expensive manuring. Since it grows and matures in a comparatively short time, we need to furnish a reasonable excess of plant food in order that the crop may be abundantly supplied, even though unfavorable conditions occur. It is a crop which is particularly benefited by potash and we must therefore provide that element in the largest proportion; and as it is not an exhaustive crop, we may expect considerable increase in soil fertility due to the unused residue.

After the potatoes are removed the land, on account of the frequent cultivation of the potato crop, is in fine mechanical condition essential for the rapid germination and early growth of wheat. It is also well supplied with plant food because of the manure applied to the previous crops in excess of their needs.

For the wheat, therefore, such home supplies of manure as are available may be applied after plowing and well worked into the surface soil with the addition at time of seeding of 200 pounds per acre of dissolved bone, or a mixture of 100 pounds each of ground bone and acid phosphate. In spring, if the crop does not show a vigorous condition, sow broadcast 100 pounds per acre of nitrate of soda. By this method the manuring is accomplished at a minimum expense, and the phosphates which are so essential for the proper development of the grain are provided, partly in an immediately available form, partly in a form that will gradually decay and feed the crop at later stages of growth. The nitrogen is applied when the plant has greatest need for it and in a form immediately available, while for potash the plant depends entirely upon the accumulated soil supplies. The hay crop, which follows, if it consists of clover, will be able to make normal growth with added supplies of phosphoric acid and potash only, which

may consist of a mixture of equal parts of acid phosphate and muriate of potash at the minimum rate of 200 pounds per acre.

This method of fertilizing should not be changed from year to year, but followed in the succeeding rotation courses, and it will enable the farmer to secure an increased yield and improvement in soil at a minimum expense. The principles involved may also be applied in other lines of farming, modified by character of soil, climate and kind of crop. In market gardening the amounts supplied should be proportionately increased, and a larger proportion of the more active forms used, because in this case quick-growing crops which belong to the high value class are produced. For fruit trees, which feed slowly and continuously, the mineral elements, as already explained, should be applied in greater amounts, and may be derived from the cheaper and more slowly available forms.

SUMMARY.

1. Commercial fertilizers are mainly valuable because they furnish the elements — nitrogen, phosphoric acid and potash — which serve as food, not as stimulants.

2. The kind of farming in the past and the demands for special products in the present make their use necessary in profitable farming.

3. In order to use them profitably the farmer should know — (*a*) that nitrogen, phosphoric acid and potash are the essential manurial constituents; (*b*) that the agricultural value of these constitueuts depends largely upon their chemical form; (*c*) that these forms are contained in specific products of a well-defined character and composition, and may be purchased as such from dealers and manufacturers and may be mixed successfully on the farm.

4. The agricultural value of a fertilizer bears no strict relation to the commercial value; the one is determined by soil, crop and climatic conditions, the other by market conditions.

5. The variations in the composition and value of manufactured fertilizers which contain the three essential constituents are due to variations in the character and in the proportion of the materials used.

6. The ton basis alone is not a safe guide in the purchase of these commercial fertilizers. Low ton prices mean either low content of good forms of plant food or the use of poorer forms. Fertilizers, high grade both in quality and quantity of plant food, cannot be purchased at a low price per ton.

7. The best fertilizers cannot exert their full effect on soils that are too dry or too wet, too compact or too porous. They can furnish but one of the conditions of fertility.

8. The kind and amount to use should be determined by the value of the crop grown and its power of acquiring food.

9. A definite system or plan should be adopted in their use; "hit or miss" methods are seldom satisfactory, and frequently very expensive.

COMPOSITION OF THE PRINCIPAL COMMERCIAL FERTILIZING MATERIALS.

	Nitrogen.	*Available phosphoric acid.*	*Insoluble phosphoric acid.*	*Total phosphoric acid.*	*Potash.*	*Chlorin.*
1. Supplying nitrogen —	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Nitrate of soda	15·5 to 16					
Sulphate of ammonia	19 to 20·5					
Dried blood (high grade)	12 to 14					
Dried blood (low grade)	10 to 11			3 to 5		
Concentrated tankage	11 to 12·5			1 to 2		
Tankage (bone)	5 to 6			11 to 14		
Dried fish scrap	7 to 9			6 to 8		
Cotton-seed meal	6·5 to 7·5			1·5 to 2	2 to 3	
Castor pomace	5 to 6			1 to 1·5	1 to 1·5	
2. Supplying phosphoric acid —						
South Carolina rock phosphate			26 to 28	26 to 28		
South Carolina rock superphosphate (dissolved South Carolina rock phosphate)		12 to 15	1 to 3	13 to 16		
Florida land rock phosphate			33 to 35	33 to 35		
Florida pebble phosphate			26 to 32	26 to 32		
Florida superphosphate (dissolved Florida phosphate)		14 to 16	1 to 4	16 to 20		
Boneblack			32 to 36	32 to 36		
Boneblack superphosphate (dissolved boneblack)		15 to 17	1 to 2	17 to 18		
Ground bone	2·5 to 4·5	5 to 8	15 to 17	20 to 25		
Steamed bone	1·5 to 2·5	6 to 9	16 to 20	22 to 29		
Dissolved bone	2 to 3	13 to 15	2 to 3	15 to 17		
Thomas slag				[1]11·4 to 23		
3. Supplying potash —						
Muriate of potash					50	45 to 48
Sulphate of potash (high grade)					48 to 52	·5 to 1·5
Sulphate of potash and magnesia					26 to 30	1·5 to 2·5
Kainit					12 to 12·5	30 to 32
Sylvinit					16 to 20	42 to 46
Cotton-hull ashes[2]				7 to 9	20 to 30	
Wood ashes (unleached)[2]				1 to 2	2 to 8	
Wood ashes (leached)[2]				1 to 1·5	1 to 2	
Tobacco stems	2 to 3			3 to 5	5 to 8	

[1] In good Thomas slag at least eighty per cent. of the phosphoric acid should be soluble in ammonium citrate, *i.e.*, available.
[2] Cotton-hull ashes contains about ten per cent. of lime; unleached wood ashes, thirty to thirty-five per cent.; leached wood ashes, thirty-five to forty per cent.

SOME PRINCIPLES APPLICABLE TO THE PRUNING OF FRUIT TREES.

By J. F. Cass.

The object sought from the pruning of the trees of an orchard or garden is to regulate the wood growth and fruit-bearing functions of the trees. An orchardist soon learns to distinguish his trees as representing two classes, viz.: Those producing a large amount of wood growth, but little fruit; and those producing much fruit, but lacking in vigorous wood-producing qualities.

Now the grower has ample means at hand, and working in harmony with the principles that nature has pointed out, to in a large measure compel his trees to do his bidding in respect to carrying out his will in these lines. As far as possible it should be kept in view, and as a general practice leading to the greatest success, that in the first planting of the trees and afterwards, varieties that are naturally feeble growers should have the stimulating influences of a rich soil, and a more or less continued cultivation of the same, to insure sufficient wood growth; while varieties naturally rampant growers, might succeed as well or better without too much forcing or stimulation by such methods. This is an elementary rule or proposition.

But the grower always, and outside of these means, has methods at hand to check any too abnormal wood growth at the expense of the fruitfulness of the tree, as he has also other methods by means of which he can increase the vigor and wood production of kinds that, other things being equal, would remain but feeble and straggling in their habit of growth, and short lived in their existence.

It has been observed that if when a tree is crowned with foliage in full growth in the early summer season, either through accident or design, it is then pruned or deprived of many or a portion of its branches, it has the result of suddenly checking its growth, and the same effect is produced, though in a milder form, by the pinching off of the terminals of its twigs, and thus checking, for the time being, any extension of growth in that direction. The tree thus brought to a comparative standstill, in the period that nature designed for its growing season, immediately proceeds to make provision, as when the age of puberty or maturity of growth obtains, to "reproduce its species," and quite commonly as a rule fruit buds will

become formed before the close of the season, for the fruiting of the succeeding year, when otherwise such would not be the case. In any case the tendency to produce a large amount of exuberent wood growth, as is somewhat common on our fertile valley lands, is checked by this course. By such means, principally trees of the pear kind, that are often found with us growing to the height of 40 to 50 feet, and with corresponding spread of branches, are grown under the Cordon methods common in the gardens of France and England in rows one or two feet apart, and of but a few feet in height.

So, on the other hand, when a tree shows a feeble and comparatively lifeless condition it may be quickened and a vigorous growth induced by a simple close pruning of the tree in the dormant season. This appears to excite, and nature apparently then endeavors with a redoubled energy to repair the loss sustained; and strange as it may seem, yet I believe it is a well established fact, that if one third to one half of the new growth of young trees are cut off each dormant season during the first few years after planting, the trees at the end will be fully as large or larger than would be the case had they not been pruned at all. This, then, is the teaching of nature.

Now, taking advantage of the revelation of nature's ways, always largely obtainable by means of intelligent and close observation, we may harmonize our methods for obtaining desired results therewith. Trees that are making entirely too much growth for the best results as regards fruiting, and this is quite often the case with us under the influences of our fertile soils and genial climate, we have the means to lessen such growth by a judicious pruning in the early summer. Trees that may seem tardy in bearing, and whose growth it is desired to keep in check to a limited extent, may be pruned in late summer, while varieties given to excessive fruitfulness at the expense of the vitality and vigorousness of the growth of the tree should always be pruned in the dormant season; and this, indeed, when there is no superabundant wood growth that seems desirable to cut away, such pruning being to insure the production of such growth when before it was lacking.

Then, again, the same results of keeping in check or regulating the wood growth of the trees may be by a judicious system of root pruning, or by taking advantage of the opportunities afforded by an *unnatural selection*, so to speak, of a root system that is foreign to the family or class of tree grown. As, for example, the working of the pear family upon the roots of the quince tree, and thereby subserving the same purpose or effect of holding in check as by root pruning, because of a more limited and weaker form of root growth, the natural tendency of the pear kind to develop into a large and strongly growing tree. The same result is also attained in the case of the common apple tree by working it on a naturally smaller growing member

of the same species (e. g., the Paradise stock), as is often resorted to by nurserymen in growing the "dwarf trees" of this family of fruit.

Thus, then, while we cannot in all respects correct, form and bend to our will things that in nature are designed to fulfill some specific end and purpose of their being, because there is a larger, more powerful and beneficient purpose and will wisely beyond our reach, yet while not doing too much violence to those principles that are common to natural conditions, we may be richly rewarded by an increased enjoyment of the rewards open to intelligent and wisely directed effort in these lines of horticultural work. An intelligently directed effort has really a wide field in power to train and to bend the energies of the trees of our orchards and gardens to the yielding of their best returns, and all in harmony with the well-defined laws governing their being.

In closing, a word of caution would seem to be properly in place: Severe early summer pruning should not be done but under exceptional circumstances and with great care, as a tree at that season closely pruned may receive a check that would require years to recover from. The stem of a fruit tree cut off near the surface of the ground in the dormant season will almost invariably send up new shoots; but if the tree is cut down when in full growth in the summer season it will be nearly surely killed outright; and every practical farmer knows that the early summer season is the time to cut brush and small tree growth to insure against their further sprouting and existence.

FUNGUS.

By Charles L. Dailey.

Webster defines the word *fungus* as "a cryptogamous plant, or a flowerless plant; one which does not fructify by means usual to others."

A *parasitic fungus*, as "a plant that grows and lives on another, or deriving nourishment from some other living thing."

The study of fungi and fungus diseases, is, for many good and sufficient reasons, beyond the field of most horticulturists, so far as classification, life history and remedies are concerned. The extreme minuteness of the fungus plant, its spores or seeds invisible to the eye, and the myriads of forms in which it is found, make the study impractical, save to the man of scientific training; one who has a thorough knowledge of botany, mycology, or vegetable pathology, and who handles the microscope with a master's hand. To such men is due the wonderful progress made in this direction during the past few years, and to them must we look for future developments. I do not wish to insinuate, however, that the practical grower has no part to perform in the subduing of these foes that are now spreading over our land with alarming rapidity. A general can do little without an army, but what would an army do without a general? The growers are the army, and the scientist is our general. He plans and directs, we act and report, and no grower should hesitate one moment to give his time and attention to such work. These men are our best friends; they work silently and carefully, and it is to be regretted that we, basking in the sunshine of their freely-given knowledge, so soon forget to credit the givers.

The state board of horticulture lays no claims to original scientific investigation, further than to report to higher authority for solution, new observations in the field. They, however, are expected to be informed on known results, to collect and distribute such information as has been definitely arrived at, and observe for investigation any new disease that may appear.

It requires no great skill to know when a man is sick, but to diagnose his disease and prescribe a remedy requires the services of a trained physician. So it is with trees. We, as growers, can always tell a sick tree if we watch, but if it be a new disease we must have expert or scientific workers to name the trouble. While this is true, it still remains that some one must, to attain best results, collect and distribute this knowledge among the growers for practical use. To meet them in personal contact, to watch

results and observe for further study, to ascertain and prevent the spread of pests and diseases dangerous to the industry of horticulture, and encourage every favorable result. This, I understand to be a part of the duty of the state board of horticulture. At present I know of no other disease or pest which so threatens the horticultural industry as parasitic fungus. It is to be found everywhere on body, branch and leaf of trees, while fruit and berries suffer equally as much. During the past season many trees have died from this cause. The study of fungi is still in its infancy. A half-dozen or more eminent investigators in different parts of the country are giving their entire time to its study; still there is comparatively little definite literature upon the subject as it occurs in Oregon, and what we have is much scattered. In the following remarks it is the writer's object to place before the growers, in as concise a form as possible, a short reference to such fungus diseases, as particularly occur and have been brought to his notice here in Oregon. He claims no originality in the matter, but simply has compiled from published facts what seems best suited to practical wants in the field among us.

DEADSPOT.

This very serious malady was first brought to the public notice about two years ago. No doubt it has existed in this climate for many years, and that hundreds of apple and pear trees have succumbed to its ravages. But little was done publicly to remedy the evil until, through the efforts of the state board of horticulture, the agricultural department at Washington was induced to send to our aid an earnest and thorough scholar in vegetable pathology or mycology, in the person of Prof. Newton B. Pierce. He at once took the matter up in a careful and systematic manner, and it is expected will soon issue a complete bulletin on results. Although Professor Pierce has not completed his investigations relative to this disease, he has given us sufficient public data to warrant protective measures being taken by growers this season. True, deadspot is beyond doubt the result of a parasitic fungus, and in all probability is transmitted from tree to tree by means of spores blown hither and thither by the wind or carried by insects. So far, the true spot has been shown to exist on apple and pear trees only, although a disease very closely allied to it attacks prunes, cherries and peaches, which may in time be shown the same.

Deadspot, as its name implies, shows itself in dead spots, on all sides of the trunk or body of the tree, and, following up the limbs, breaking out at intervals nearly to the ends. New growth of bark never forms under a dead spot in this disease. In treating the disease the dead bark should all be removed by cutting around the spots and scraping the affected parts clean. These spots should then be treated with bordeaux mixture. The mixture may be made according to the following formula: Six pounds of copper sulphate, 4 pounds of quick lime, 45 gallons of water. Dissolve the

copper sulphate in 10 or 12 gallons of water in a barrel; slake the lime in another barrel to a milk of lime; strain the milk of lime through a wire screen into the copper solution, and add water to make 45 gallons; apply at once. The entire orchard should be treated after the leaves have fallen, and a second time just before the buds start in the spring, the object being to prevent the further spread of the disease by killing the spores at the surface and also the exposed fungus where excisions have been made.

GUMMOSIS.

Closely allied to deadspot (and it may yet be shown the same) is a disease known as gummosis, which attacks cherries, peaches and prunes with an appalling fatality. Trees have succumbed to this disease in large numbers the past year, and no orchard seems entirely exempt from it. From every quarter of the state anxious inquiries have come to us for information relative to this malady. Except in a general way but little can be said in reply, as investigations are still incomplete, but are actively in progress.

Gummosis first shows itself to the average grower, or rather its presence, by a reddish, shiny, unnatural appearance of the bark early in the spring. Upon investigation it is found the bark is usually dead where this appearance exists. Later on in the season gum pockets form and about fruiting time much gum oozes forth; the disease follows up the tree and breaks out in places along the main branches, gumming badly. By removing the bark what seems to be fungus spots and discolorations are found. The living bark appears yellow and sickly. Sometimes the disease will girdle the branches at the crotch of the tree and it dies. The roots seem perfectly healthy; often new bark will form underneath, apparently dead gum spots, and the tree seemingly is recovering, but the following year it usually breaks out again and the tree dies or is very weakly.

The best authorities, to whom infected trees have been sent for study, outline the disease as follows: The causes of gummosis are not always the same, or apparently not. It is probably a disease of the physiological nature and affects nearly if not all of the stone fruits. It may appear in either of two forms, local or constitutional. Local gummosis appears in the form of gum pockets on trunk or branch in isolated situations. The constitutional form may also show gum pockets, but these will be found upon examination of cross sections of the wood to be connected with each other by a series of gum-filled cells in the wood, which may commonly be seen with the eye as dark-brown lines of cells. Either local or constitutional gummosis is most likely to affect trees which have been quite dry at one time and wet at another. A parasitic fungus has not yet been shown to exist in the case of gummosis, but authorities are not yet prepared to say positively it does not. As a remedy the following suggestion is from Prof. Newton B. Pierce: "Cut out as much of the diseased bark as possible and immediately treat the parts with bordeaux mixture. Go over the entire orchard and spray

thoroughly with the same spray; this would be going at the matter from the practical side, and is the surest way in view of the fact that the prime inciting cause of the gummosis is still in doubt. One thing is sure, it will aid trees rather than injure them, if it is not possible to wholly check the trouble."

The state board of horticulture has numerous experiments under way for observation this coming summer and hope later on to report more fully on this serious disease.

CURL-LEAF OF THE PEACH.

This heretofore serious trouble to peach-growers has, during the past two years, been shown to be caused by the presence of parasitic fungus. A thorough spraying in the spring, before the buds swell, with bordeaux mixture or salt, lime and sulphur, has been found a perfect success in correcting the evil.

There are many other kinds of fungi prevalent in our orchards, which are too well known to require detailed description, such as apple scab, shot-hole fungus, rust of the prune, mildew of the apple, etc.

As a general proposition, it may be set down that sulphate of copper (blue vitriol) is the best fungicide known, and is best applied in the form of bordeaux mixture. Sulphur is good, but is inferior to copper solutions, hence, when one has arrived at the conclusion that fungus is his trouble, it follows that bordeaux mixture is the best-known remedy.

Winter spraying is much more effectual than summer in most cases, and if only one treatment is to be given, just before the buds swell in the spring is best.

To prevent apple scab, prune rot and other attacks on fruit, treatment must be given as published in spray calendar.

Further observations and results will be given the public in relation to fungus and its diseases as fast as definite knowledge accumulates upon the subject.

THE CODLIN MOTH.

By Hon. J. R. Casey.

The past few years have been very serious in regard to the codlin moth in its ravages on our apples and pears, and I think if we knew more of its life and habits we would have more success in fighting it. Mr. L. O. Howard, entomologist at Washington, D. C., describes it as follows: "Its general appearance is a grayish brown. The fore wings are marked with alternate, irregular, transverse streaks of gray and brown, grading from light to dark from base to tip. The sexes are distinguished by a black peneil of hairs on the hind wing of the male only. It has found its way all over the United States, making its first appearance in Sacramento in 1874. It is found in nearly all of the English colonies, in South Africa, in New Zealand, in Australia, in Siberia and in the sub-tropical regions of Van Diemen's Land, but there is no record of it being in South America"

There is no doubt that it is four-brooded in Oregon, while in the Northern United States and Canada it is two-brooded, and in the south it is three-brooded.

The round of its life may be briefly summed up as follows: Soon after the blossoms have fallen and the fruit has begun to set, the moths issue from their cocoons in which they have wintered, and which are usually situated in cracks in the bark on the trunk of the tree, when they pair and lay their eggs at the apex of the forming fruit in the little crumpled up spot caused by the falling off of the calyx; the eggs are hidden, sometimes two or three to a single apple or pear. They are sometimes laid on the smooth cheek of the apple, and sometimes at the hollow by the stem, but these are both unusual. The young larvæ on hatching out eat their way immediately to the core of the apple, where they live and grow, casting off their skins four times and excavate large, irregular cavities around the core. The larvæ reach full growth in about four weeks from the time of hatching, and the infested apples now begin to fall to the ground. The larvæ now bores a hole to the side of the apple, and issuing, crawls about for a suitable place to spin its cocoon and transform into a codlin moth. In the great majority of instances it returns to the trunk of the tree and crawls up some distance and hides itself in a crevice under some partially detached piece of bark when the thin, slazy looking cocoon is spun. Occasionally the apples do not fall. In this case the larvæ on issuing, crawls

down the tree instead of up, and usually spins at a higher point near the crotch or even above it. The pupæ state of this generation lasts between two and three weeks; the moths then issue and begin to lay their eggs for the second generation. It is estimated that each moth lays about fifty eggs. The eggs of the codlin moth are semitransparent, cloudy white with a yellow tinge. The shell is finely sculptured, oval and about one sixteenth of an inch in diameter.

Prof. F. L. Washburn, late entomologist of the Oregon experiment station at Corvallis, says: "A diligent study has been made of the length of time occupied in the different stages in the life of the codlin moth. In the fall of 1891, a breeding cage was placed out of doors in a situation where it could have as nearly as possible the same natural conditions as regards temperature and moisture as the insects would be subject to during the winter. In this cage several cocoons were placed from May 16 to May 26, 1892. Moths emerged from the cocoons very rapidly; from these and from observations in the field, the following data has been conclusively determined. The life of the moth is from 10 to 15 days, pairing and egg laying taking place during the latter part of that time, after which the moth dies. Each female lays a large number of eggs, but apparently only a certain proportion of these eggs develop, as many of the eggs were found flattened and dead, looking like small trout scales. On sound apples, the eggs hatch in from five to ten days. The larvæ when first hatched are hardly the twentieth of an inch long, and in the cases under observation, broke or ate their way through the shell and entered the apple somewhere else than at the spot occupied by the egg. I cannot say, however, that they do not eat directly into the apple without breaking the shell. The life of the larvæ in the apple lasts about four weeks or a little less, at which time they leave the apple and remain in the pupa state about three weeks, when they emerge as moths ready to repeat their destructive work." The last brood in the fall, however, do not leave the cocoon until spring, remaining as larvæ in their silken nests throughout the winter.

The natural enemies of the codlin moth, so far as known, are the woodpecker, the creepers and the black-capped titmouse, which run up and down the bark of trees, find the cocoons in the crevices and quietly rob them of the enclosed pupa. The downy woodpecker and the chickadee have been shot by Professor Trimbal and their stomachs examined and were found to contain the larvæ of the codlin moth. The observations of F. C. DeLong, of Marin, California, are of great interest, and place in the strongest light the necessity of scalding all boxes and barrels where apples have been kept.

It seems that on the Novitia ranch there are 31,000 trees on the 250 acres of land, and the codlin moth was not noticed there until June, 1891, when Mr. Matthew Cook discovered a single pupa. Later on the fruit was gathered and carried into the apple-house, very few infected apples being

noticed during the winter months. Mr. DeLong had mosquito netting put over all the windows except one, the key of which he put in possession of a trusty man. The moths began to appear about the month of April, and up to May 27, 2,671 had been killed and counted. From May 28 on, a daily account was kept and the moths issued in great numbers until near the end of August. The number caught and killed altogether by Mr. DeLong's assistant was 15,627, and the highest number for the single day was 990 on June 15. It transpired, moreover, in the discussion of this statement that a large number of bats were accidently shut up in this apple-house, and doubtless many additional codlin moths were killed by them.

Many experiments have been made to trap the codlin moth with lights, pans of sweetened water, diluted syrup and sweetened vinegar with no success. The codlin moth is not attracted by a light, and in place of it you catch other moths and insects, such as beetles, true bugs, wasps, etc., the most of which are more beneficial than injurious to the fruit-grower. It seems that banding trees has been tried for many years with good success.

Dr. La Barron, state entomologist of Illinois, made a test on four trees with the wire shingle trap and using a single band on each tree, which resulted as follows: Number of worms caught in the trap, 80; number caught in the bands, 188; or 268 on four trees. Then he took five trees and placed two bands on each tree, leaving about two feet between the bands, which resulted as follows: Number caught in the upper bands, 282; in the lower bands, 350; or 632 on the five trees. In the bulletin of April 21, 1894, F. L. Washburn says: "The effectiveness of wrapping burlap bands around the apple and pear trees as adjunct to spraying has been referred to before; yet it must be kept in mind that the worm found beneath the band has accomplished its work and spoiled the apple in which it has been working, and at the same time many of the worms so killed would, had they lived, produced female moths which would have laid hundreds of eggs upon the fruit.

In our experiments banding commenced in July, and the bands were examined every five days. In examining, the greatest numbers were found on August 25—78 worms—and on August 31, 76 worms. This test was made on 40 trees. Inasmuch as it has been found that the larvæ live four weeks in the apple before seeking a hiding place, it is evident that the worms found in such numbers on August 25 and August 31 were hatched from July 25 to July 31, consequently the trees should have received a good spraying from July 15 to July 25. In my research of the history and habits of the codlin moth, and from all authority I can find on the subject in regard to the rapidity with which they multiply, I am satisfied that we must work as hard, and in fact a great deal harder, to keep down the codlin moth than we have to do to keep down the San José scale.

We must combine and all who have trees infested with codlin moth must go to work and try to kill as many of them and their larvæ as possible. If we do this, we may reasonably expect to have from 75 to 80 per

cent. of sound fruit, and until we can find something better, I would recommend as follows: First—Scrape the loose bark of the body of the tree and the main limbs. It is better to do this before spraying for the San José scale. Second—Place a band from four to six inches wide (doubled) around the tree about one foot from the ground and another about two feet above it. These bands can be put on by a nail or cord, being careful to draw the upper edge tight around the tree. Third—Examine the bands every five or seven days and kill all the larvæ found in them. Fourth—In spraying for codlin moth, use a very fine spray, a spray like a fog, so it will settle on the fruit. A coarse, strong spray striking the smooth skin of the apple glances off and does very little good. Fifth—Always aim to cover the apple with the spray, being careful to strike the blossom end. Sixth—Commence spraying about the twenty-fifth of May, or as soon after as possible, and be sure to give a good spraying between July 15 and July 25. Spray at least every three weeks. Seventh—Thin your apples and don't let them hang in clusters. When the apples touch each other the spray don't get in, but the worm does.

SOME PRUNE PESTS.

By PROF. A. B. CORDLEY, entomologist Oregon experiment station.

Throughout what may be termed the experimental period of prune-growing in this state, a very large proportion of the growers gave but little attention to those insect and fungus pests which were slowly but surely gaining a foothold in their orchards. They were interested in questions of planting, of pruning, of cultivation and were particularly interested in the problem of carrying their orchards through the nonproductive period with as little expense as possible. To such an extent was this policy followed in many of the smaller orchards, that even the essential operations of cultivating and pruning, not to mention spraying, were so badly neglected that thousands of trees succumbed, not to the ravages of any particular insect or fungus pest, but to actual starvation.

So far as the production of prunes is concerned, however, the experimental period may be said to have ended several years ago, but the unfortunate results obtained in marketing the '97 crop tended to leave the financial aspect of the subject still uncertain, and many growers became even more chary than before about going to any unnecessary expense in the care of their orchards. As a result of this extended period of neglect the various pests have been allowed to multiply almost at will, and in the near future the problem of their control must, and no doubt will, receive considerable attention.

We are pleased to notice that there is already an increased interest in the subject. The past season has been a profitable one. A large crop has been grown, a considerable portion of it has been cured — more or less satisfactory — and the product has been marketed at a fairly remunerative price. Confidence in the future of the industry is becoming stronger, and with this returning confidence comes, together with the determination to give the orchards better care, the desire for more extended information — particularly on that phase of the subject which has been so sadly neglected — the nature and methods of control of the most serious pests. We have recently visited several of the important prune-growing regions of the state, and have found people alive to the importance of the subject as they have never been before, with the result that more extended preparations for spraying are being made.

In the following pages we shall not attempt to treat the subject of prune pests at all exhaustively. To do so would take far more time and far more space than we feel justified in taking at the present time.

We shall, however, attempt in a more or less popular manner to consider those pests, which up to the present have shown themselves to be of the most importance, leaving for future consideration several more or less obscure diseases, which, as yet, have caused but little injury, but which promise in the future to be of considerable importance.

NATURE OF DISEASE.

A prune tree may be said to be diseased when it presents any variation from the normal condition of a vigorous tree, and this may include almost every stage of variation, from a slight impairment of the vigor of the tree, due to some slightly unfavorable condition of soil or climate, to the actual premature death of the tree through some active agency.

ENVIRONMENT IN RELATION TO DISEASE.

The growth and development of a plant depends upon its nutrition, and this in turn is made up of numerous factors. There must be light and heat, water and oxygen, carbonic acid in the air and various kinds and proportions of nutritive materials in the soil, and the latter must be in such a physical condition that these elements are readily available for the use of the plant. When all of these factors are present in the most favorable proportion, the plant is vigorous and said to be healthy. It is quite probable, however, that the condition is never realized where all of these factors are present in ideal proportions and act together in the most favorable manner possible. One or more of them is almost certain to be either deficient or in excess, and this interferes to a greater or less extent with the development of the tree, *i. e.*, there is a variation from the normal development, and while the tree may show no definite signs of disease, it is still more or less unthrifty or "sickly"—the degree of unthriftiness being proportional to the degree of variation from the normal, of the conditions under which it is growing. Hence the more nearly those factors, which go to make up the plant's environment, are present in the proper proportions, the more vigorously will the plant thrive and the longer will it live, while it will be unthrifty, sickly or diseased, just in proportion to the existing variation from ideal conditions under which it is growing.

We are thus brought to the conclusion that in addition to the numerous well-marked diseases which are due to the active agency of some insect or fungus pest, there are also a large number of diseased conditions which can only be ascribed to a constitutional or physiological weakness of the tree, due to unfavorable environment.

The selection of the location for a prune orchard, or for any orchard,

therefore, becomes of prime importance. If well cared for an orchard will thrive for a few years under very unfavorable conditions, but as the trees increase in size, and particularly after they have reached the bearing age, their demands upon the soil are immensely increased — an enormously enlarged root surface must be developed, and unless the soil is rich enough to supply the demand for its elements, unless it is deep enough to give room for the extensive root growth and unless it is dry enough in winter, moist enough in summer and porous enough at all seasons of the year to admit a sufficiency of oxygen, the tree will surely, although it may be slowly, starve.

The prune tree, if it is to remain thrifty and healthy, must be planted in an open, deep, rich soil. A tree planted upon the granite soils of Southern Oregon may thrive for a time; but these soils are proverbially "short lived," and sooner or later that tree will become unthrifty, sickly, diseased. There are few soils better adapted to the growth of prunes than are certain of our so-called "red lands," but unfortunately there are many of these soils which are shallow, and we can hardly expect that trees planted upon them will continue thrifty and productive for any considerable time without artificial fertilization. The rich, black loams of the Umpqua and the Willamette valleys and the rich, sandy loams of the river bottoms are ideal prune lands when well drained, either naturally or artificially. Many orchards, among the best in the state, are growing in such well-drained soils, but one of the worst features of prune-growing in these localities is that too often the soils are not well drained. Trees growing in such soils may thrive for a time, but sooner or later they will show signs of disease, due to "wet feet." The drain scoop must be included with the spray pump as a means of overcoming the disease of plants growing in such soils.

We are decidedly of the opinion that excessive gumming, or the so-called "gummosis," of prunes and cherries is very largely the result of a physiological weakness due to various unfavorable factors of environment, rather than to any specific, active agency. In other words, we are convinced that gumming is only an evidence of a diseased condition which may be due to any one of numerous causes, and that it is not itself the cause of disease. Any injury or wound to a peach, cherry or prune tree is followed by the exudation of gum. A similar injury to a conifer is followed by an exudation of resin. Both the gum and the resin have a healing function. They are nature's dressings for these injuries. It seems natural to infer, therefore, that in "gummosis" the flow of gum is only for the purpose of healing some injury.

We are well aware that many theories have been advanced to account for "gummosis." It has been said to be due to a fungus, to a bacterium to an insect working about the base of the leaf, to root galls, to transplanting the trees in too strong soil, to hard, undrained clay soil unfavorable to the

tree, to atmospheric conditions, such as frost injury, excessive rainfall, etc., and to any unfavorable condition which may reduce the vigor of the tree.

We doubt very much whether any of the first three causes mentioned have anything to do with what we call "gummosis," but we are much inclined to the belief that any one of the others is capable of producing a physiological condition of the tree that will result in gumming. Professor Hedrick considered that the chief cause of gumming is frost injury, and in Bulletin No. 45, of the Oregon experiment station, maintained his views in one of the best articles we have seen on the subject. We cannot, however, agree with Professor Hedrick that this is the only cause, or even the chief cause of gumming, for, although it is true that this is more general during those seasons which follow widespread injury from frost, still it is equally true that it is present to a greater or less extent every season; and its greater prevalence during such seasons is due simply to the fact that one more cause has been added to the many others which may produce the same effect.

If this be true it is quite evident that no treatment can be advised which will prevent gumming under all circumstances. Each grower must study the conditions under which his trees are growing and must endeavor to improve them wherever possible.

SOME ROOT DISEASES.

It is not unusual for an apparently healthy tree to grow thriftily until perhaps July or August, when the leaves of one or more branches, or even of the entire tree, will commence to wither, and in a few days the diseased branch or tree is dead. In many cases, no doubt, the trouble is due to lack of drainage. A continued excess of water about the roots during the winter months kills all or nearly all of the roots, but the tree is able in spring to throw out its leaves and blossoms, to develop them partly, at least, by the nourishment which had been stored during the preceding season's growth, and to make an apparently thrifty growth so long as the few remaining surface roots can supply a sufficiency of moisture and other necessary elements. After a few warm, dry days in summer, however, the surface soil becomes dry and these few roots are no longer equal to the task of supplying sufficient moisture to provide for the greatly increased transpiration from the leaves, and the tree dies from lack of moisture even though there may be sufficient beneath the surface of the soil. In such cases the leaves of all the branches wither and die at the same time, the withering being usually first noticeable at the tips of the branches.

The peach and prune-root borer, to be described later, also occasionally causes the sudden death of a part or of the whole of a tree in midsummer, but in addition to these two causes there is also a fungus disease of the roots which produces a like effect, and of which we wish to speak briefly.

During the season of 1897, the writer, together with the horticulturist at the station, received an urgent invitation to visit some extensive orchards which had been planted by a land improvement company and subsequently sold off in blocks to suit the purchaser. Some of the orchards were just coming into bearing, being loaded with a fine crop, and the purchasers were looking forward to a profitable harvest, when suddenly a considerable number of the trees were observed to wither and die.

We found the trees growing in a deep, rich, well-drained, red soil and for some time were unable to satisfy ourselves of the nature of the trouble, but on digging about the roots of the trees, its cause became at once apparent. In every case so examined, on stripping the bark from the larger roots and from the collar, an extensive mass of felted, white mycelium was found to be present and the characteristic odor of mushrooms was readily observable.

We have never seen the fruiting form of the fungus causing this disease in the vicinity of diseased trees, but the characteristic appearance of its mycelial growth beneath the bark of the roots corresponds so closely with European descriptions of *Agaricus melleus* that we are convinced that it belongs to this or to a closely related species.

In Europe *Agaricus melleus* lives as a parasite upon the roots of all coniferous and of deciduous trees of the genus *Prunus*. As a saprophyte it is found nearly everywhere upon the dead roots and stumps of trees and also on the timbers of bridges, mines, etc. In this country, Scribner has described a root-rot of the grape as due to this fungus, and Meehan has suggested it as a possible cause of peach yellow and of a rhododendron disease.

The sporophores, or "mushrooms," are developed in fall and from these the white spores are spread, either by the wind or by being brushed off by passing objects. On germinating, these spores produce first of all a filamentous mycelium from which are later developed brownish-black, lustrous strands, or rhizomorphs, from 1-25 to 1-12 of an inch in diameter. These rhizomorphs extend through the soil in all directions, at a depth rarely exceeding 4 or 5 inches, and bore into any roots they may encounter. After having once penetrated the bark, the rhizomorph expands into a snow-white mycelial mass which spreads throughout the cortical tissues causing their death as far as it extends. We have the past season observed cherry trees in which this white, felt-like mycelium had extended beneath the outer bark nearly, or quite, 2 feet above the surface of the ground.

European writers recommend that the spread of the disease may be prevented by surrounding the infected trees by a shallow ditch, so that all surface roots may be severed, although there seems to be some doubt of the efficacy of the process. Scribner, in treating of the root-rot of the vine, recommends that all infested vines be immediately removed, that the soil be thoroughly drained, that the ground be kept clear of vegetation for several years and that affected areas be isolated by trenching. Meehan men-

tions an instance in which a rhododendron was cured of the disease by an application of flowers of sulphur. We would suggest that if the base of the trunk and the ground surrounding infected trees be thoroughly sprinkled with bordeaux mixture or simple copper sulphate solution it may prevent the spread of the fungus, and that if the tree be then well fertilized it will be much more likely to recover from the disease.

PEACH TREE BORER.

As previously stated, this pest, by working about the collar of the tree or in the larger roots, may cause the sudden death in midsummer of the whole or part of the tree. Such instances are, however, comparatively rare, although many trees are annually more or less seriously injured by its ravages.

The adult insects are beautiful, wasplike moths, the males and the females of which differ so much that they are readily mistaken for entirely different species. They are from one half to three fourths of an inch long and have a wing expanse of from four fifths to one and one half inches. The body of the female is deep steel blue in color, with the fourth and sometimes the fifth segment of the abdomen orange. The fore wings are of the same color as the body, while the hind wings are clear, transparent, bordered by a band and fringe of deep blue and with a few scales of the same color at the base and along the front margin. The male is somewhat smaller than the female, has small flecks of yellow upon head and thorax, the second, fourth, fifth and sixth segments of the abdomen are narrowly banded with yellow, and all four wings are transparent, with a narrow border and fringe of steel blue.

I have no direct evidence concerning the time of year at which the moths appear in Oregon; but a large series of larvæ collected in October contained specimens varying in size from those not more than one fourth grown to those fully grown. This indicates that the period of egg deposition extends over a considerable time, thus corresponding with the well-known habits of the insect in the east, where the moths are known to issue and deposit eggs from early May until the first of October. We may safely infer that any time between May and October these beautiful, wasplike moths are flying about in the bright sunshine depositing eggs upon the bark of prune and peach trees. These eggs are scarcely more than one fiftieth of an inch long by half as broad and nearly oval in shape. They are usually deposited at or near the surface of the ground, but occasionally one occurs high on the trunk or even on the lower branches. They are deposited singly and are stuck to the outside of the bark by a gummy substance, no effort being made by the moth to secrete them in crevices of the bark, as is generally supposed. The eggs in a few days hatch into very minute and very active larvæ, which immediately bore into the bark, usually entering through some minute crack. Having once entered the inner

layer of bark the larvæ bores downward until it is just beneath the surface of the ground, where it remains feeding upon the inner bark and sapwood throughout the remainder of the season. During the winter it remains dormant in its burrow, but on the opening of spring commences to feed and continues to do so until fully grown. In the case of the larger ones this is only for a short time, but the smaller ones undoubtedly continue their injury until well past midsummer.

A recent examination of some twelve hundred trees has shown that at this season of the year (April) larvæ can be found in all stages of growth, from those not more than one fourth of an inch long to those nearly or quite fully grown. They are yellowish-white in color, nearly cylindrical, the head and first segment is brown and when fully grown they are about one inch long.

When grown the larvæ usually leaves its burrow, enters the ground and builds from its own floss and particles of bark, held together by silken threads, an elongated cell or cocoon, in which it transforms to a rather slender, brown pupæ. Although no pupæ have been found as yet this season, a number of full-grown larvæ were present in the soil at the base of the trees, where they had evidently begun to construct their cocoons. From this fact it is inferred, since the pupal stage lasts but a few days, that the earliest moths emerge in this locality not far from May 15, and since larvæ in all stages of growth can be found, it would seem that they will continue to pupate and to emerge as moths throughout the summer.

In badly infested trees the larger roots and even the base of the trunk may be entirely girdled and the tree greatly injured or even killed outright. The presence of a borer in a tree is always indicated by a mass of jelly-like gum mixed with sawdust-like castings about the base of the tree, at or just beneath the surface of the ground, or at least by the presence of the sawdust-like castings.

So far as our observation goes all varieties of prunes are alike attacked, irrespective of whether they are grown upon peach and plum stocks. Mr. Daily states that they have injured his petites most; Mr. Pratt, that in his orchard the Italians are worse affected.

All successful means of preventing injury from these borers are based upon the fact that the moth deposits her eggs upon the outside of the bark, and the young larvæ when hatched are compelled to eat their way into the tree from the outside. Bearing this fact in mind, it is evident that any application to the tree during the summer months, that will prevent the moth from depositing her eggs upon the bark, or that will poison or otherwise destroy the young larvæ at the beginning of its career, will prove perfectly effective in preventing all injury from these borers.

Many methods have been employed to accomplish these results, all of which can be conveniently grouped under two general heads, viz., (1) mechanical protectors, and (2) various destructive washes.

Several kinds of tree protectors, warranted to prevent all injury from borers and other pests, have been placed upon the market. Some of them are very effective; but for cheapness and efficiency there is probably nothing better than to wrap the base of the tree with a band of heavy paper 8 or 10 inches wide. The earth should be removed from about the base of the tree, the wrapping applied so that it will extend 2 or 3 inches below the surface of the ground, and the soil replaced. Care should be taken to confine the wrapping closely to the trunk with strings, otherwise the moth is liable to crowd in and deposit her eggs upon the bark. Instead of paper, a wrapping of straw may be used successfully if care is taken to leave no crevices through which the bark is exposed. At first thought the process would seem to be very expensive, but Mr. Daily, who has wrapped a very large portion of the trees in his 35-acre orchard, tells us the expense is almost nothing as compared with cutting the grubs from unprotected trees. He found, with little experience one man could wrap 600 trees per day, and the expense for material is very slight indeed. The total cost of wrapping his trees was about $16, whereas he had just previously expended nearly $300 in "worming" the same trees. It is hardly necessary to add that his trees will be protected by wrappers in the future.

Washes.— Various washes are used to prevent the moth from depositing her eggs, or to coat the bark with a substance impenetrable to the larvæ, or to destroy it before it has penetrated the bark.

For the first purpose Dr. Lintner recommends a wash made by mixing 1 pint of crude carbolic acid in 1 gallon of soft soap, then diluting with 8 gallons of water.

For the second purpose probably no wash is better than a good stiff whitewash, to which a little glue has been added to make it more permanent and impenetrable, while for destroying the young larvæ nothing is better than some poison applied with some substance that will make it stick to the bark.

For all practical purposes the combined effect of all three of the above washes may be obtained by using a good whitewash to which has been added a little glue, a small amount of carbolic acid and a little paris green. Use about 1 pint of the acid and 2 or 3 ounces of the paris green to each 10 gallons of whitewash, and apply the mixture thoroughly with an old broom or good stiff brush. The application should be made between the first and fifteenth of May, and should be repeated whenever it appears that the coating is becoming imperfect. We are of the opinion that this is, withal, the cheapest effective preventive of injury from the peach-root borer.

The above mentioned measures are only preventive. When once the larvæ has entered beneath the protecting cover of the bark and exuding gum it is beyond the reach of any external application of insecticide substances. The only satisfactory remedy then is to examine the trees care-

fully, once in the fall and again in the spring, remove a little dirt from the base of the tree, and whenever the presence of the borer is indicated by the exuding gum or sawdust-like castings, cut it out. It is then a good plan to prevent decay by covering the wound with grafting wax.

Even with experience, this method of controlling the borer is quite expensive and should be employed only as supplementary to one of the preventive measures above described. At best it only removes the borer only after the injury is done, and then only at the expense of a more or less serious wound to the tree. First use one of the preventive measures, then, if an occasional tree becomes infested, use the knife.

Various other methods of destroying the borer have been recommended. Apparently good results have been obtained by scooping out a shallow basin about the base of the tree and filling it with hot water, while others, by using a small oil can or similar device, inject a small quantity of kerosene oil or bisulphide of carbon into the burrow made by the borer, and report that it is effective. All these methods, however, are fully as expensive and troublesome as the "knife remedy" and have the disadvantage that one leaves the tree not knowing that the work has been effective.

THE SAN JOSÉ SCALE.

There is no group of insects of greater economic importance than that which contains the peculiar creatures known as scale insects, or simply scales. There is hardly a shrub or tree that is not subject to their attacks, and often entire orchards are seriously injured by their ravages. The often minute size of the creatures and the difficulty of destroying them, together with their wonderful prolificacy, all combine to make them formidable pests of the orchardist. It is only necessary to mention the mealy bug of greenhouses, the fluted scale of California, the peach scale of southeastern United States, the New York plum scale, or the well-known subject of this article, to establish the truth of this statement.

The life history of scale insects is very peculiar and bears an intimate relation to the proper remedies to be used in destroying them. The fully grown individuals are covered with a waxy excretion which may be of a white, fluffy nature, or may form a dense protective scale. These scales vary in shape, size, color and markings with the different species or kinds, and give to the insect a peculiar lifeless appearance, so much so that it is difficult, in many cases, to realize that they are covering living organisms which may be seriously reducing the vitality of the infested plant. But if some of these scales be carefully lifted from their resting places there will be found under them soft, fleshy bodies, the insects themselves or numerous eggs. In the former case the females will usually begin to produce living young or eggs on the advent of settled warm weather, and will continue to produce them for several weeks. In the second case the eggs will all hatch nearly at the same time.

In either case the very young scales are active, six-legged microscopic creatures, which at first crawl rapidly about but soon attach themselves firmly to some tender growth and feed upon the sap. When first hatched the males and females are very similar, but their future development differs greatly. The females grow rapidly, but when fully grown consist only of a fleshy body covered by a more or less dense scale. The legs, antennæ and eyes have entirely disappeared, and of all the appendages of the body only the well-developed mouth parts remain. The body gradually becomes distended with eggs or young and after they are produced the female dies. The fully grown male, instead of being motionless and without appendages, as is the female, is a minute, active creature with two broad wings, long antennæ, six legs, well-developed eyes but no mouth parts.

Of all scale insects that attack our deciduous fruit and forest trees the San José scale is by far the worst. Dr. Howard, United States entomologist, writes that "there is perhaps no insect capable of causing greater damage to fruit interests in the United States, or perhaps in the world, than the San José scale."

This pest was discovered in San José, California, about 1870. Where it came from is not definitely known, but at the present time it is pretty well distributed throughout the states of California, Oregon and Washington and in British Columbia. It has also invaded Idaho on the north and Arizona and New Mexico on the south, and within the last few years has become widely distributed over the eastern states, where it seems equally at home and equally injurious as on the Pacific coast. In Oregon, it is found in Ashland, Rogue river valley, Umpqua Ferry, and at several localities in the Willamette valley, in the western part of the state, and at The Dalles, Walla Walla valley and Union, in the eastern part of the state. Everywhere it infests the apple, pear, peach, plum, prune, cherry, currant, rose, willow and numerous other deciduous trees and is a serious pest of each, occurring, as it does, on all parts of the plant, the limbs, the leaves and the fruit. It does not attack coniferous trees nor does it breed upon rocks, as has been several times reported by observers in different parts of the state.

The worst feature of an attack by this pest is the fact that the insect is so small and inconspicuous that it often remains unnoticed, while at the same time it spreads so rapidly over the branches, leaves and fruit that is is rarely a tree can survive an unchecked attack for more than two or three years. The tree may be seen to lack vigor but often the cause of the disease is overlooked. And yet the San José scale is easily recognized when once seen. On badly-infested plants the small, nearly circular, gray scales lie close together, even overlapping one another, and give the appearance of a gray, scurfy deposit on the infested part. The natural, rich-red or brown color of the branch is obscured and appears as though covered with fine ashes. If this scurfy covering be scraped, so as to crush the insects under the scales, a yellowish, oily appearance is produced. When present in comparatively

small numbers on smooth bark, or on the fruit, the appearance of the scale is even more characteristic since each individual scale is surrounded by a distinct, reddish discoloration. This is so conspicuous that it is of great use in enabling one to recognize, at the beginning, an attack which otherwise might remain unnoticed for some time.

Although the San José scale has been known as a fruit pest for more than twenty years, its full life history, which has an important bearing on the subject of remedies to be used, was not worked out until three years ago. At that time Dr. Howard, aided by Mr. Pergande, demonstrated that the insect develops as follows:—

"The winter is passed by the nearly full-grown insects under the protection of the scale. Early in April in this latitude (Washington, D. C.) the hibernating males emerge, and by the middle of May the overwintered females mature and begin to give birth to a new generation, continuing to produce young for a period of upward of six weeks, when they reach the limit of production of young and perish.

"The adult gives birth immediately to living young, differing in this respect from most other scale insects. Ordinarily eggs are deposited beneath the scale, which, in the course of a longer or shorter time hatch, and the young larvæ make their escape and migrate to different parts of the plant. In the case of some scale insects the female fills its scale with eggs in the fall and perishes, the eggs wintering over and hatching the following spring. In others the insect hibernates in the nearly matured condition, as does the San José scale, and deposits eggs in the spring or early summer. The viviparous habit, or the giving birth to living young, possessed by the San José scale, finds a parallel in many other insects and frequently in plant lice. * * *

"The newly-born larvæ is an almost microscopic creature of pale orange-yellow color, with long, oval body and with the customary six legs and two feelers. The long, thread-like proboscis with which the juices of the plant are sucked up is doubled on itself and lies in an invagination of the body wall, the tips only projecting.

"After crawling about for a few hours the young larvæ settles down and slowly works its long, bristle-like sucking back through the bark, folds its antennæ and legs beneath its body and contracts to a nearly circular form. The development of the scale begins even before the larvæ becomes fixed. The secretion starts in the form of very minute, white, fibrous, waxy filaments, which spring from all parts of the body and rapidly become more numerous and dense. * * * The scale is formed by the slow matting and melting together of the filaments of wax. * * *

"The male and female scales are exactly similar in size, color and shape until after the first molt, which occurs twelve days after the emergence of the larvæ. With this molt, however, the insects beneath the scale lose all resemblance to each other. * * *

"The length of a generation is determined by the female and covers a period of from thirty-three to forty days. Successive generations were carefully watched throughout the summer and it was found that at Washington four full generations are regularly developed, with the possibility of a fifth generation."

It was further shown that among the wintering individuals the males greatly predominated and that—

"The numbers of both sexes are insignificant compared with the progeny of the later generations. The males still predominate in the second generation, but in the third and fourth generations the females considerably outnumber the males, in one instance the females from a single mother reaching the astonishing number of 464, with 122 males from the same parent, making the progeny of this insect 586 insects. Taking 200 females as the average of the different generations for the year, the product of a single individual from spring to fall amounts to 1,608,040,200 females. * * * The males may be estimated at the same number, giving a total of 3,216,080,400 descendants from a single insect in a single season. It is not to be expected, of course, that all the individuals from a scale survive and perform their function in life, but under favorable conditions, or in the case of a tree newly infested or not heavily crusted, the vast majority undoubtedly go through their existence without accident. Neither the rapidity with which trees become infested nor the fatal effect which so early follows the appearance of this scale insect is therefore to be wondered at.

"Owing to the long period during which the female is continually producing young, the different generations or broods in the course of the summer are not distinctly marked and merge insensibly into each other—so much so that at almost any time there will be found young larvæ running about over the trees and scales in all stages of development. * * * In this. latitude the first young appear, as noted, by the middle of May. * * * The larvæ are continously present on the trees until further hatching is prevented by severe frosts.

"In autumn, or when further development is stopped by cold weather, hibernation is begun by scales in all stages of development, from the white, minute, down-covered, recently-hatched young to the mature and full-grown females and males. Unquestionably many young perish during the winter, and normally in spring quite a percentage of the smaller or half-grown scales will be found to have perished. It is very probable that many females have union with the males in the fall, but the majority of them are unquestionably immature, and are fertilized in this latitude early in April by over-wintered males which, as we have noted, appear nearly a month before the first young of the spring brood."

Since the female scale is motionless and permanently fixed to the branch on which it feeds, it is frequently asked how it is that the scale has spread so rapidly over such a vast territory? Observation has shown that even in

its active larval stage the insect is incapable by its own exertions of getting more than a few feet from the tree on which it was born. But by crawling upon birds, insects or other animals, or by being wafted short distances by the wind, it is readily transported from tree to tree in the same or neighboring orchards. From one locality to another it is invariably carried upon infested fruit or nursery stock. It would therefore seem that the state board of horticulture, the nurserymen of the state and everyone else should be encouraged in every way possible to continue the efforts to prevent the sale or shipment of nursery stock, except under a certificate of inspection, and to prevent the sale of infected fruit. A strict enforcement of the law would undoubtedly cause serious inconvenience and loss to a few individuals, but considered from the point of view of the growing horticultural interests of the state, it is seen to be essential.

In our warfare against this insect we are aided by several minute parasitic insects and by some predacious ones.

The most important of the latter is perhaps the twice-stabbed ladybird (*Chilocorus bivulnerus*). This is a shining black species, a little more than one eighth of an inch long, and nearly as wide, and with a bright-red spot on each wing cover.

In the east the most useful of these ladybirds is a minute, black species, known as *Pentilia misella.* It is scarcely as large as a pinhead and is shining black in color. Until recently it was supposed to be a distinctly eastern species, but in 1894 it was found at Marysville, California, and in March, 1896, Mr. H. E. Dosch, horticultural commissioner of the first district, sent me for identification specimens he had observed feeding upon the scale at at Hillsdale. I immediately wrote Mr. Dosch as follows: —

"The small beetle * * * is evidently *Pentilia misella*, a little coccinellia beetle, which is one of the most efficient enemies of the San José scale in the east. * * * I would suggest the specimens be sent to each of the other commissioners to enable them to recognize the species, and that they search for it in their localities. If it should prove to be not very widely distributed in the state, undoubtedly much good could be done by introducing it in the localities in which it does not exist."

Later my identification of the species was verified by Dr. Howard.

The most satisfactory remedy for San José scale is to thoroughly spray the trees in winter with the lime, salt, and sulphur wash. Summer sprays are almost entirely useless against this particular insect. This is due to the fact that the female insect, herself protected under a scale that is practically impervious to any spray that the tree can endure when in leaf, continues to give birth to living young for a period of several weeks; and the young scales, which at first are easily destroyed, inside of two or three days secrete a covering that is also practically impervious to any washes that can be applied. Hence, to eradicate the insect by summer spraying would require an application every two or three days for several weeks.

The lime, salt and sulphur wash is best prepared as follows: Slack 50 pounds of lime, then add 50 pounds of sulphur, and 50 to 75 gallons of water. Boil the mixture for an hour or more, or until the ingredients are practically all dissolved; then add 50 pounds of salt, boil for a few minutes more and dilute to 150 gallons. This formula is based upon results obtained by Mr. Emile Schanno in his extensive experiments in the fourth horticultural district.

The best results are obtained by applying the mixture with considerable force in the form of a rather course spray. The insects multiply with such astonishing rapidity that it is essential, if one hopes to satisfactorily control them, to destroy nearly every specimen. It is therefore necessary that the spray be dashed upon the infested branches with such force that it will drench every part. One such thorough application of the above wash each year will prove entirely satisfactory in keeping the scale in check in the worst infected orchard.

BROWN ROT.

After the experience our growers had with this disease in '97 it is almost needless to suggest that it is likely to prove an important factor in determining the profits on a season's crop. It is true that this season it caused but a comparatively slight loss, only, however, because the conditions for its most rapid development were not present, and the very fact that it was present in nearly every orchard where it still remains, taken with its capability of rapid multiplication and spread under favorable conditions, makes it imperative that every grower should learn something of the nature of the disease and of the means of controlling it.

Brown rot is a fungus disease of various fruits—principally the drupaceous sorts—and develops rapidly only under favorable conditions of heat and moisture.

An observant person in passing through almost any of our prune orchards when the "green fruit" is being picked, will see here and there a prune that seems to be partly or wholly covered with an ashy-gray or bluish-gray "mould." Occasionally several such specimens will be seen together in a cluster.

If one of these "mouldy" prunes is examined under a small hand lens the "mould" will be seen to consist of numerous tufts of minute, thread-like projections, and if a little of the "mould" is scraped or shaken from the fruit and examined with a microscope, magnifying from 200 to 300 or more diameters, it will be seen that each of these minute "threads" is composed of a number of very small oval bodies joined end to end like a string of beads. In fact, it is the bead-like appearance of its fruiting form that gave to this fungus its generic name of Monilia.

These minute, bead-like bodies are the spores of the fungus, and each infested fruit is capable of producing hundreds of thousands of them. If

a few of these spores are placed in a dry cell and examined under a microscope it is seen that they remain unchanged for an indefinite time. I have seen such spores that had remained unchanged for several years. On the other hand if a few more of the spores are placed in pure water or prune juice, and likewise examined under the microscope, it is seen, in two or three hours, that each spore has commenced to push out a little germ tube. In other words, the spores "sprout" and continue to grow so rapidly that in from 24 to 48 hours, they will themselves begin to produce spores. I have myself observed this process time and again, and by inoculation experiments have succeeded in producing "brown rot" in many kinds of fruit, including in addition to most of the stone fruits, apples, strawberries, raspberries, green hazelnuts, and rose hips.

Now let us consider the above facts in their relation to orchard conditions. During the dry summer months, although the spores may be and probably are present, the disease does not readily develop because the spores will not germinate in the absence of moisture. But as the crop ripens, the skin of an occasional fruit here and there becomes broken, allowing the spores free access to the moist interior, or several prunes may hang in a cluster so that the surfaces in contact with each other may retain the moisture of dew long enough in the heat of the day for the spores to germinate. Thus it is that we have the occasional "mouldy prune" referred to above as being present in our orchards during the time of green fruit shipments.

Through the agency of winds, insects, etc., the almost innumerable spores produced on these infested fruits are constantly distributed throughout the atmosphere and on to other fruits. However, in the absence of sufficient atmospheric moisture to keep the skin of the fruit moist, these spores fail to germinate except under favorable conditions above mentioned. Hence the truth of the statement that is often heard "If no rain had come our Italian prune crop would have ripened all right."

But often it does rain during prune harvest, and even when it does not rain there are many days when the air is saturated with moisture—days that may fairly be called "muggy." The conditions are often almost perfect for the germination of the spores, and when the spores are there ready to germinate the result is the fruit rots. Nothing else can be expected under the circumstances.

A great deal of rottening fruit has been left in the orchards this fall, either on the trees or on the ground. Countless millions of spores are thus left in all the infested orchards ready to germinate, under favorable conditions, next summer; but in addition to the spores already present it has been proven that the fungus has another method of surviving the winter, or a period of scarcity of fruits on which to develop. The mycelium of the fungus—the "roots" which ramify through and through the tissues of the fruit, disintegrating the cells and thus causing the rot—may remain dormant throughout the winter in the decaying fruit, whether on the ground

or in the tree, and with the advent of warm weather in spring will produce an abundant crop of spores.

Should the conditions of heat and moisture be favorable for their germination at the time the trees are in bloom these spores may be the cause of a more or less serious blighting of the blossoms and even of the young and tender shoots, but whether this occur or not the spores will be present to infest the fruit whenever the conditions become favorable.

This disease is preëminently one of those by which the prune-grower is forced to "prove his faith by his works." It multiplies with such exceeding rapidity, under favorable conditions, that it is nearly useless to attempt to control it after it begins to spread rapidly under such conditions. All methods must be preventive. And yet a grower may almost be excused for hesitating to apply expensive preventive measures for the purpose of controlling a disease that mav not cause any serious injury for years, owing to the lack of weather conditions favorable to its rapid spread during the fruit ripening period. Still it may be safely predicted, now that the disease is well established, that any prune or cherry grower who fails to employ preventive measures deliberately takes the chance of losing a large proportion of his crop, even though such loss may not occur every year. Preventive measures are in the nature of an insurance, but it must be admitted that in this particular case the rates are high and the results are not always satisfactory. As yet no one, as far as I know, has been able to entirely prevent loss from the disease under conditions that are favorable to its development, although we may so lessen its ravages as to be able to mature a crop without serious loss by the following process: *First*, destroy all fruit left in the orchards, either by gathering and burning it or by turning into the orchards sheep or hogs to eat it. In either case one should make certain that no fruit remains hanging to the trees throughout the winter. *Second*, spray with bordeaux mixture once just before the buds swell in spring and once just after the blossoms fall. A third application ten days or two weeks later would probably lessen the disease somewhat, but it is doubtful whether it would pay. *Third*, wait and watch during the dry summer months, and when the crop begins to ripen, if an occasional mouldy fruit is seen pick and destroy it, and if, at any time during the ripening period, the weather turns warm and moist spray the trees once or twice with a weak solution of acetate of copper.

THE APHIDÆ.

By Dr. J. R. Cardwell.

The insect, order *Aphidœ*, is at once the most fecund and destructive in animal life, and in its varied species infests nearly all plant life, every class of tree, shrub and plant, having its peculiar species known by the amateur and gardener as plant lice. The life history of this insect is remarkable and puzzling, conflicting with the accepted ideas of generation. To illustrate, the first brood hatched in the spring from little shining black eggs deposited in the fall on the branch of the apple or pear, are all females, and in turn produce only females, and these are all agamic; sex is no business of theirs. Agamic, that is to say, producing the young without mating, and alive, as do quadrupeds. The order of insect life is the mating of male and female, the fecundated egg, the larvæ or first stage of life hatched out—a voracious worm or grub—then the pupæ, a more advanced stage, and then the winged insect as the moth or butterfly. Not so with the aphis. Yet to show themselves amenable to law, late in the season these independent agamic females produce a brood of winged males and females, which, following the law of nature, do mate and lay eggs, but this is the exception and not the rule, which is as follows: Early in the season, and as stated, through the season, only females are hatched from the black, shiny, little egg deposited on the pear or apple twig, only visible to the keen sight of the careful observer. The newly-hatched insect takes its place on a succulent twig and plants her punching beak into the tender bark, and begins with her strong suction pump to suck sap, and soon to produce a living brood. In an almost inconceivably short time she has a family of from 10 to 20 females; each in turn attaches itself to the twig, and produces, in like manner, so that in a few days the twig is literally covered, and the young are crawling over each other seeking new fields, so to repeat the fecund process, until in a short time every branch and leaf of the growing tree is covered with a sluggish, creeping, living mass, pumping out the sap and producing its kind.

Observation has demonstrated that, starting with a female, this agamic process may go on for four years without the male impregnation of the egg. Verily, a remarkable freak of nature and a marvel of production and reproduction. From the practical standpoint of the orchardist, the green and woolly aphis are a serious menace and a veritable problem to deal with. Like

other productive, fruit-growing countries, we have many families of these. Green aphis, black aphis, white aphis and aphis of all colors, of which the apple and pear and woolly aphis are the most persistent and unyielding enemies—most difficult to exterminate Quassia, tobacco, whale-oil soap, resin wash, kerosene emulsion and other sprays have been used, and may be used effectively, but the work must be done thoroughly, early and late and often, to keep the pests down.

Heretofore orchardists have depended on the parasitic enemies to do this work. How far we may do this remains problematical. The family of beetles called ladybirds and their larvæ have proved very effective friends, and in most localities have kept them well in check. The larva of this beetle is a most voracious feeder on the whole aphis species, and in the end it is hoped will measurably exterminate or render them harmless. Ichneumon or lace fly, three varieties or more, are also known to be doing good service in this work. These are its most active and cruel exterminators; the fly follows them industriously during the whole season, depositing its eggs in the body of the young, making of it the cradle and food for the larva of the future fly. This larva is called the aphis lion. The body of its host is eaten away, carefully avoiding the vital parts, until the time for it to emerge into the pupa state, when it eats out the life of its animated cradle and cupboard, then starts out on its life in the pupa form. The ichneumon shows remarkable intelligence in always depositing her eggs in the young brood, seeming to know that the older ones would die before the grub hatched would arrive at the age for its departure in the pupa form. A smaller lace wing produces an aphis lion, a veritable rapacious miniature lion, alike destructive. At the end of its pupa life it rolls itself up into a small ball and weaves around itself a glistening white cocoon, which looks like a seed pearl. It has now put off its greedy, murderous ways, and changed its spirit, presumably as the body changes. Certainly a great change is taking place. After a time a circular hole is cut in the cocoon, and out of it emerges a beautiful dainty creature with delicately veined green wings and a pale green body, slender brown antennæ, and a pair of large eyes that shine like melted gold. It is sometimes called golden-eyed or laced-winged fly. This beautiful fly shows great forethought in perpetuating her kind. She knows her depraved predacious young aphis lion devours everything in the shape of an egg or insect within its reach. She is aware of the fact that if she deposits her egg on the leaf that the first larva lion hatched out would destroy the eggs and young as they came forth. Hence to guard against this she spins stiff silken stalks in symmetrical rows, and on the top of each she deposits an egg; the first born of the brood emerges and crawls down the stem to the surface of the leaf, and goes out in search of food unconscious of the abundance of food just above its head on the tips of the other stalks. Some ingenious, enterprising calculator has estimated that but for the numerous and voracious enemies that feed upon or germi-

nate in the bodies of the aphis, all the vegetation they infest would be destroyed from the face of the earth in one season, and the race of *Aphidæ* become extinct for want of food. Always with the green aphis may be seen congregated numerous busy little ants. The relation of the ant to the aphis family has often been a subject of curious and mistaken speculation, and not now by everyone well understood. The aphis secretes a sweet, honey-like fluid from two little projections or teats on the back of the sixth abdominal segment. Ants are great consumers of this honey milk, and protect the herd of aphidean cows; they fondle and caress and stroke them with their antennæ to induce a free flow of the nectar from the abdominal tubes. They may be seen at all hours of the day busy milking their queer kine. In the fall of the year, as egg producing begins, ants gather eggs and carry them to their nests and carefully guard and protect them from marauding enemies until they hatch in the spring, when the young are carried out and placed on the plant or tree from which they were taken, on the most succulent vigorous growth, filled with the flowing milk-producing sap. Should a storm portend or frost threaten, they are carried back to the nest until all danger is over, when they are again brought out; truly an infallible signal service, and no mistake in the forecast. May we not learn from the ant? Ants are always on the lookout for new colonies which are being started in out of the way places, by winged females, and when a new colony has been discovered a messenger is dispatched to the nest to bring a sufficient guard to protect and take charge of the new find, and as the herd increases additional numbers are called into service as herders and milkers. An ant will take a gravid female to a favorable growing juicy branch and start a new colony, then return and bring her companions to the new field.

The Eriosoma aphis, woolly aphis or woolly-bodied aphis, that is, bodies covered with a fine cotton wool: These insects do not possess the honey-dew secreting organs, consequently the ant is never found tending and cultivating them. This is perhaps the most threatening and difficult to combat of any or all the aphis family — the apple orchard pest. The pernicious scale may be practically exterminated with one thorough spraying with salt, sulphur and lime. The green aphis may be kept down and innoxious by occasional spraying with quassia, tobacco, resin wash or kerosene emulsion. The ravages of the codlin moth may be reduced or kept to a minimum of five per cent. to ten per cent. by three or four timely sprayings with white arsenic or paris green. Not so with the woolly aphis, blown by each passing breeze from orchard to orchard, like flecks of swansdown, mantling branch and leaf with a white, silken sheen; with the fecundity of the green aphis infesting root and branch, with puncturing beak sapping the life-blood of the tree to the very extremity of its roots, in a very short time the apple orchard is blighted with the so-called "American blight" beyond reclaim, and often before the damage is discovered or realized by the vigilant orchardist. For two obvious reasons this blight, when once well estab-

lished in an apple orchard, root and branch is almost immune to the ordinary insecticide sprays: *First*, the fine cottony, apparently impervious covering, is a sufficient protection against all spraying compounds thus far used; *second*, their habit of burrowing deep down into the ground, following the roots to their very extremities like the grape phylloxera; thus entrenched they are beyond the reach of any practical treatment. In this case again the beetle ladybird larvæ and lace-winged fly comes to the rescue, doing effectively the work of keeping down or exterminating this arch enemy of the apple orchardist. In the early stage, in a small way, this may be accomplished by a careful application with a small brush or feather of kerosene oil to the infected spots, and by digging away the earth from the surface roots, say six inches, and applying hardwood ashes, air-slacked lime or carbon bisulphide, then replacing the earth. Kerosene emulsion is recommended by the agricultural department at Washington for the spraying.

Elm tree aphis: Last season I had an opportunity to study the elm tree aphis, which, without any warning, in one season almost blighted all the elm trees in the city of Portland. They came and went in one season. The first public notice was a profuse dripping from the curled-cupped leaves, covering the sidewalks under these trees with an unsightly, dirty, sticky compound, offensive and disagreeable to the lady pedestrian. Upon examination the cupped and curled leaves were found filled with a living mass of sluggish, brown *Aphidæ*, an excreted white powder enveloped innumerable myriads of young, varying from almost microscopic in size to the full-grown insect. The whole tree was coated with a dirty, brown, sticky, honey dew, continually exuded and dripping from the leaves to the sidewalk, giving the tree a darkened, blighted color. The early brood of these *Aphidæ* were agamic females, but later winged males and females were produced, and the black, shiny egg deposited on the bark of the tender twigs. Evidently some unfriendly climatic change, or deadly parasite not discovered, proved fatal, for this year they have not been seen, or rarely seen.

A PAPER

By Emile Schanno.

I find there is a very generally prevailing opinion that anyone can be a fruit-grower, that all that is required is to plant a few trees, and in a few years harvest a crop of prize fruit. A man may learn a trade so that he understands it thoroughly and can manage any branch of it, but this is not the case in fruit-growing. When a man commences to grow fruit he commences at the same time to grow a good crop of diversified knowledge, for something he had not thought of will come up every day or two to confront and resist him. Most of the fruit pests are, if not of modern origin, at least universal within the last few years. Most of the old settlers will remember what fine apples we had in the Willamette valley twenty-five or thirty years ago, but they are there no longer. The "Oregon red apple," famous then all over the coast, comes no longer from the valley. Neglect has furnished the golden opportunity for the pests, and I am sorry to say that the pests have not neglected it. There are a few isolated localities in the valley where good fruit is still grown, but they are the exceptions that prove the opposite rule.

When I first became a member of this board three years ago apple scab was unknown in my district, but, in spite of the watchfulness of our growers, it has made its appearance in a few orchards within the last year. I find the most common and most grevious mistake made by those who begin fruit-growing is the lack of care in selecting the location for their orchards.

My advice would be to select your intended orchard ground in the month of February. If you then find the soil is too wet or miry, leave it for some other crop, and do not plant fruit trees in it. It is also a good plan to dig holes in the land two or three feet deep. If the water stands in these do not put out trees, unless some provision is made for thorough drainage. If these holes are sunk to a depth of four or five feet, it will also demonstrate whether or not the hardpan is a source of danger. I have been asked at different times by orchardists, "What is the matter with my orchard? It don't do well." My answer is, "Dig a hole and you will find hardpan too near the surface," and this proves to be the case in almost every instance.

Another mistake is in selecting the trees, for it is seldom, indeed, that the varieties for commercial value, at least, are not too many. A fruit looks nice, or the name sounds nice, and a few of this, that and the other kinds

are selected, resulting in a mixture of good, bad and indifferent fruit—the bad and indifferent prevailing—and the owner is often ignorant of the names of his assorted fruits.

Another and a serious mistake is made in crowding the trees, and this applies to all kinds of fruit trees. Downing recommends from thirty to forty feet as the distance at which apple trees should be planted from each other, but many who know better than he insist on crowding them to twenty-five or even twenty feet. The result is that when the trees get ten years old the limbs will touch, making it difficult to take care of them, and then they soon begin to show signs of decay. At the same time the fruit, not getting enough sun, deteriorates in quality. Good fruit must have the sun. You may quote Downing, and you may advise the orchard planter against crowding, and he will admit you are correct, but when you visit him in another year you will find the advice unheeded and the trees crowded. Most orchards are trimmed too much. After the trees get three or four years old they should be left alone; the only thing required is to see that the limbs do not cross one another and that plenty of sunshine gets into the trees. Every fruit-grower should have one or more horticultural papers; they are cheap, and every number will add to your information.

It is needless, perhaps, to say that every orchardist should have a good spray-pump. It is good policy to buy the best and to avoid those with leather valves or packing, as they are almost certain to give a good deal of trouble. Whatever pump is selected, however, should be taken care of and cleaned and oiled when you are through using it.

It is the opinion of some that spraying does no good. The reason of this opinion is that they judge by work improperly done. There is not more than one out of five who does the work properly, and the neglect often begins in not having the wash properly mixed. Spraying when improperly done is a waste of time and money. I find that some of the fruit-growers spray when the wind is blowing; then they invariably spray the trees only on one side. They are afraid the spray will get on their clothes. When you spray for San José scale you want to be sure and cover every part of the tree. If you leave only a small place, two or three inches, on a limb you will have enough scale left to stock the whole tree. Anyone who has a good deal of spraying to do, I would advise having a pair of goggles and something to protect their face; also their hands. While I have had a great deal of experience in my district with the San José scale, a great many of our fruit-growers don't seem to mind the scale, as they spray every winter with the lime, sulphur and salt. This gives the tree a good healthy appearance. You will have to use a good deal of judgment when spraying, and when you find that it looks like it was about ready to rain you want to use the spray a little stronger than usual, and also more salt, as it will not so easily wash off. You will see by my report in regard to the experience I have had in boiling the lime, sulphur and salt that the only thing

that gives the wash any strength is the sulphur; the lime helps the sulphur to dissolve; the salt is to make it stick on the tree. I have experimented about ten different ways in boiling this solution of lime, sulphur and salt, and they all amount to about one and the same. This is the result of one of them: Ten pounds of sulphur, ten pounds of lime, and twenty gallons of water. Boiling fifteen minutes, it shows seven degrees; boiling thirty minutes, it shows nine degrees; forty-five minutes, ten and a half degrees; one hour, it shows twelve degrees; then I add the salt, ten pounds, and let it boil for half an hour longer. You will see that by adding ten gallons of water you will have thirty gallons of wash. Never add to much cold water while boiling.

FRUIT EVAPORATION.

By Henry E. Dosch.

"No man has come to true greatness who has not felt in some degree that his life belongs to his race, and that what God gives him, He gives him for mankind."—Philips Brooks.

I have been asked by our secretary to contribute a paper on this very important question, and in accepting, I felt that it was necessary to tell some truths, perhaps unpleasant to some, yet truth must prevail. We are all going to school yet, as it were, learning how to evaporate our prunes to the best possible advantage, for producer and consumer. I therefore kindly ask you to consider what I may have to say, not as criticism, but in the same friendly spirit in which it is given.

The subject of fruit evaporation has been made "the" topic of this meeting, and very properly so, as the prospects for a full crop are most excellent, and we should be thoroughly familiar with the best modes of curing our fruits and placing them upon the market in merchantable condition. It is surprising, however, that, after many papers read on this subject at our various meetings, and the full discussion following them, together with the articles printed from time to time in our leading horticultural and daily papers, so very few men have profited by it. Believing as I do, in practicing what I preach, that fruit is the natural food for man, we consume in my family about 500 pounds of evaporated prunes, pears and apples, besides fresh apples and pears, stored away for that purpose, between fall till strawberries appear in the spring, fruit in some form being on our table at each meal, and on the sideboard for "between meals."

Owing to our short crop last year, I supplemented my stock by buying from my friend, Charles L. Dailey, near Salem, whom I know produces an excellent article, 200 pounds of evaporated prunes. Nevertheless our fruit gave out in March, and after being out for a couple of weeks, became real prune hungry, so went in search of them, and visited the principal retail grocery and provision stores in Portland, but did not find what I was in search of. Still I bought some, which seemed best, but what a disappointment they proved to be. It has always been a wonder to me why our own people are not consumers of evaporated prunes, but now I wonder that they eat as many as they do; if those sent to eastern markets are no better than those in the Portland market, then I am no longer surprised that the

Oregon prunes do not find that favor which they should, and are justly entitled to. Strange as it may seem to you, and much as I regret to state it, that while there are some fair prunes, there is not a pound of first-class evaporated prunes in the Portland market today. That evaporator is not yet built, or ever will be built, nor is that man born, or ever will be born, that can make a first-class evaporated fruit out of green or unripe prunes. This point is much more important even than large-sized fruit. If we desire to obtain top figures for our fruits and which will create a demand in our markets, we must make better fruit. This is all easy enough, if you would only not be in too much of a hurry in gathering your prunes, and rush them through the evaporator. Give nature a chance, and follow her example, and I assure you, if you do, you will never go wrong. I brought with me some 30 samples, so you may convince yourselves of the truth of my statement.

Now, this is all wrong. We have the finest of fresh prunes on earth; why not have the best of evaporated product? Whose fault is it? Is it the evaporator or the man who operates it, or both? While we have not yet reached the acme of perfection in evaporators, we have one or two which fill the bill pretty well, and are especially adapted for those who are not adepts in evaporation, while some experts can make fine fruit on most any dryer. For the last five years I have made it a point to visit the various fruit-evaporating plants as well as commission houses, to examine the product for the purpose of study. I find, *first*, that nine tenths of the prunes have been picked too green, which makes them woody and sour; *second*, nearly all have been dried too much, and some burned, which makes them bony, and no amount of sweating or dipping in glucose or glycerine will overcome this, both of which is especially applicable to our fine Italian prunes. It seems to me a shame that, after nature has done so much, by giving us so excellent a fruit, man should step in and spoil all her handiwork.

Fruit evaporation is as much of a science, if not more so, than fruit-raising, and requires study, care and steady attention. The man who is in charge of the evaporator must be constantly on the alert, from the time the fires are started in the morning until banked late at night, watching his furnace and thermometer, to see that the heat is even throughout the evaporator, so the prunes do not burn in one place and mold in another, and regulate his drafts according to the outer atmosphere and winds, as you all well know that heat in space is a very difficult thing to control, and he must positively know the stage of evaporation of each and every tray.

The Rural Northwest, with commendable enterprise, has taken up this subject, and it is to be hoped that good results will follow. The questions asked are all direct and pertinent, and the replies by experienced fruit-growers are to the point, and should be read and studied by all persons

engaged in the business. The question naturally arises, "What are the true principles of perfect evaporation?" to which permit me to answer.

First—Perfectly ripe fruit, even to being too soft or mushy; prunes should be allowed to drop on the ground, and not be shaken from the trees.

Second—Thorough and rapid circulation of heat in the evaporator, beginning at a low heat and finish at a high heat, allowing all the fruit to cool off some time during its process of evaporation, which is perhaps best attained by letting the fires go out in the late evening and start again in early morning. This is a very essential point; experiments made by myself have proven it a correct principle; it is practiced throughout the prune-evaporating districts in France and Germany, though they go even further, by taking out the trays and stacking them up until perfectly cold, and then replace them in the evaporator. This will assist in developing the sugar, make heavier, finer fruit, and will retain their aromatic flavor better than if allowed to remain in a continuous heat.

Before leaving the evaporator at night, it is neccessary to remove all such trays of fruit which are likely to be finished before morning, and their places filled with fresh trays; you will find in the morning that fully 75 per cent. of these will not need to be returned to the evaporator, and many others ready to come out, cured to perfection.

Third—The fruit is to be removed from the evaporator before it is quite finished, as it will continue to evaporate for several days after being placed in the bins. Where large quantities are evaporated, they should be placed on smooth, clean floors, overhead in the evaporator, to be shoveled over every two or three days for a few weeks, thus assuring uniformity of finish.

Fourth—Prunes, after being picked up in the orchard, should be graded and thoroughly washed in clean, cold water. After being spread on the trays, placed in the steambox, described by me before, for fifteen minutes, then placed in the evaporator. The object of steaming is to open the pores of the skin to facilitate evaporation and prevent dripping, or, in other words, to prevent the loss of the aromatic juices and fruitmeats, and obviate the necessity of dipping in lye solution, so objectionable to refined tastes; it makes the skin tender and eliminates that leathery substance found in most of our dried French prunes; hastens evaporation, requires less heat, and fruit will cure heavier or more meaty than unsteamed fruit.

Permit me to quote from Dr. J. F. Simonds, of Fayetteville, Arkansas, who is considered one of the best scientific authorities in the United States on fruit evaporation. After discussing the "chemistry of evaporation" of the apple, between sun-dried and evaporated fruit, and what is true of the apple is equally true of the prune, he continues: "I will now describe the process of true evaporation. It has been found that by removing a part of the water rapidly, in swift-moving currents of air, heated to 240° Fahrenheit, a different product is the result, wholly unlike either the fresh or sun-

dried fruit, and which will keep better, is more digestible and nutritious, is less acid, and will sell for more in the market. But if, after having heated the air hot enough, there is not sufficient circulation, or the current not rapid enough, the fruit will cook and then dry or burn the same as in a close oven. Apples will cook in boiling water of a temperature of only 212° Fahrenheit, or bake in an oven at 225° Fahrenheit; but, if the heated air circulates fast enough, the fruit will not cook or burn, or become itself heated to the temperature indicated by the thermometers, even at 300° Fahrenheit, for the evaporation of the water is a cooling process and every particle of vapor leaving the minute cells which contained it carries with it also a large amount of caloric in a latent form and thus keeps the heat of the apples far below the surrounding air. The chemical change which belongs to truly evaporated fruit will now begin, and the albumen, instead of being slowly dried, coagulates precisely the same as in an egg when boiled. The soluble starch existing in all the fruit, and composed of $C_5H_{10}O_5$, will, if the heat is high enough, combine with one equivalent of water (H_2O), so that now we have an entirely different combine, towit, glucose, or fruit sugar, which will assist in the preservation of the fruit instead of being liable to decomposition, as the dried starch is in the sun-dried or slowly dried product.

"All the pectin or fruit jelly remains in the cells undecomposed, or is left upon the surface by the evaporation of the water in which it was dissolved, and may be seen condensed upon the surface, instead of being decomposed and passing on with the starch and gluten into the acetic fermentation. The diastase or saccharine ferment contained in all fruit, and which is primary cause of its decay, has been rendered inoperative, and all germs of animal or vegetable life have been destroyed by the high heat. It is by this chemical change, which I have brefly described, in uniting a part of the water already contained in the fruit with the fruit starch, that these truly evaporated products are rendered more wholesome, more digestible, more indestructible, and are thereby made more valuable, not only as articles of food, but because they are not subject to deterioration and loss. And it is also the reason why a bushel of apples will make more pounds of evaporated fruit than can be made by sun-drying it, as a portion of the contained water which would otherwise be lost is retained by combining with the starch to form glucose, and the carbonic acid, which is always lost in the slow decomposition resulting from sun-drying, is retained in its natural combination with the other substances composing the fruit, and hence is heavier. These profitable and healthful chemical changes which I have mentioned are all in accordance with the laws of nature, and are certain to take place if the necessary conditions of heat and air, as I have detailed them, are properly supplied, otherwise, you will have a different product, and no matter how fine your apples, how perfect your paring, caring and trimming, or how white you have bleached them, you have not made truly

evaporated fruit, and no matter how many have been deceived by its color or full weight or fancy packing, your fruit will not stand the test of long keeping in warm, damp weather. The natural starch, gluten and albumen of the fruit, instead of being cured or made indestructible by the chemical changes which constitute the difference between the evaporated and dried fruits, will absorb moisture from the air, will swell or increase in bulk, and can be attacked by mold, will absorb additional oxygen and finally sour and decay."

As stated by me before, and so scientifically explained by Dr. Simonds, the two principal requisites in the evaporator are heat and circulation. I have demonstrated both in my own evaporator, by building a fire-brick furnace, 24x26 inches, the entire length, then pass the heat through three 12-inch pipes, back and forth, before entering the flue, which distributes the heat more regularly and is easier to control; the other by giving plenty of cold air space; when I began, I had only 80 square inches of cold air passing in, which I was assured by the patentee was quite sufficient, but soon found my prunes molding, so I knocked out some bricks, and finding the circulation increasing, kept on knocking them out, all around the bottom near the furnace, and now have over 500 square inches of cold air passing in constantly, and the circulation perfect through the 112 trays, holding 3,500 pounds of fresh fruit. Judging from the draft at the cold air holes, and the top of the vent shafts, the circulation must be between 12 and 15 miles an hour, which is none too quick.

The question as to the amount of heat necessary and length of time fruit should remain in the evaporator depends upon the kind of fruits in course of evaporation. For six years past I have experimented every year with this object in view, and have reached the following conclusions:—

FRENCH PRUNES.

Taking three trays, each filled with 28 pounds of fresh fruit of equal size and ripeness, brought these results:—

First tray—Twenty-eight pounds; 10 hours; produced 10½ pounds; very bright, but tart.

Second tray—Twenty-eight pounds; 24 hours; produced 11¼ pounds; quite sweet and bright.

Third tray—Twenty-eight pounds; 36 hours; produced 10¼ pounds; dark, but very sweet.

This proves to me that 24 hours is a very happy medium for weight and sweetness. In dry seasons the evaporated product will be heavier, being more meaty. The Italian prunes took 30 to 36 hours to produce similar results, and silver prunes 36 to 40 hours. These fruits were subjected to a heat of 180°, allowing the trays to cool off during the night. Neither of these prunes were dipped in lye solution.

BARTLETT PEARS.

One hundred pounds of fresh fruit, with skin, core and stem left on, cut in halves, produced 19.05 of dried product. One hundred pounds of peeled fruit, not cored, only halved, produced 13.7 pounds of dried product. If pears are cored, they lose too much flavor; while the peeled product is finer in appearance, and is considered by some as fancy fruit, the pears with skin, core and stem are certainly the best flavored. The peeled fruit will evaporate in 24 hours, while the unpeeled requires from 48 hours for the small ones to four days for larger ones, using 160° and allowing to cool off nights.

APPLES.

I evaporated a large lot of various kinds, mixed, peeled, cored and ringed, and found that 100 pounds of fresh fruit produced 14¼ pounds of evaporated product; they evaporated in four to six hours, with a heat of 160°.

All prunes should be graded, and only the larger sizes used in evaporation, and the smaller ones, as well as those bursted by rain, as occasionally happens in Oregon, and apples, pears, cherries, peaches, apricots, etc., not salable in their fresh state, should be conserved into jams or fruit-butter.

The two principal evaporators used in France and Germany are patterned after the American dryer, with slanting shafts, and the Alden dryer, with perpendicular shafts, the fruit being placed in at the coldest ends and finished at the furnace or hottest ends.

A pertinent and very serious question enters right here, which only practical experiments will answer, and that is: Is the finished product better, or is there any difference at all, if the fruit is pressed during its process of evaporation from the coldest to the hottest or finishing point, through moisture laden air, as is necessary in the stack, shaft or tunnel system; or if each tray carries off its own moisture, and thus pass only through dry, warm air? We know that the starch is converted into sugar quicker in dry, warm air; but does it make any difference as to weight, size, flavor and general palatability, which method is used?

I have stated elsewhere that we live in an electrical age, and in nearly all branches of business and manufacture what seems new today is old tomorrow, and so it is in fruit evaporation. We first had the oven, then the drier, now the evaporator by heat. We are already hearing the advance signals of evaporation by exhausting the air from air-tight buildings, built with steel ribs and cone-shape, to withstand the atmospheric pressure from without, as well as evaporation with cold air blasts, from which the moisture has been condensed by chemical processes. These latter must from necessity prove expensive plants, and will do doubt be the future evaporators of commercial orchards, or coöperative communities, but the small grower, who desires to evaporate his own fruit by his own labor, will

find in the scientifically constructed hot-air evaporator the plant best suited to his wants.

In conclusion, permit me to say that the time has arrived when consumers begin to discriminate between inferior and good fruit. The markets are being flooded with sun-dried fruit, sold for what it is worth, while imported French prunes, put up in fancy packages, bring good prices. We have the fresh article, which is superior to all others; why not have the best evaporated fruit as well?

THE WEATHER.

ITS RELATION TO FRUIT INTERESTS.

By B. S. Pague, forecast official director, United States weather bureau, Portland, Oregon.

Climatic or weather conditions must first be studied before successful fruit industries can be obtained. Soil conditions may be of the most ideal character, but without the proper climatic conditions fruit culture would be a failure. Experiments in hothouses with an artificial climate demonstrate just what heat or cold, moisture or dryness is necessary for certain plants, shrubs, trees, etc. On a large scale experiments must be made with nature herself to determine what vegetation is suitable for the various sections of the earth's surface. A sufficient number of years have elapsed since the greater portion of Oregon has been settled to enable a determination of what products are most suitable to the various sections, and it has been found that all fruits that are growing in the temperate zone, any place in the world, can be most successfully grown in the state of Oregon. The latitude of Oregon is the same as that of Minneapolis, Northern New York and the Central New England states, but owing to its nearness to the ocean, and the influence of the various mountain ranges, it has a climate milder than that found in Virginia. The various mountain ranges traversing the state from north to south make the many valleys, and each valley is somewhat distinct from the other. We find that the climatic conditions in the Columbia river valley, from the Cascades eastward two hundred miles, is very similar to that of the Rogue river valley, over three hundred miles to the south. The Umpqua valley, in the southwestern part of the state, covering almost the entire area of Douglas county, has a very distinct climate of its own. The Willamette valley, the largest in the state, containing some five million acres of land, has also its own climate. We find another climate along the Snake river, in the northeastern portion of the state, and along the rivers in Crook and Grant counties. A more vigorous climate is found in Klamath and Lake counties, and in the high plateau region of the counties of Malheur, Harney and Grant. It is the study of the climate of these various sections that enables the fruit-grower to determine where the variety that he desires to produce will be most favored. In the valleys removed from the immediate coast line, and west of the Coast range of mountains, you find a moist climate, and especially favorable to certain products. This, in turn, is very distinct from all other climates in the state,

and the fruits that grow to perfection in the Columbia river valley would fail in these coast valleys, and the *contra* statement is also true. The nights of Oregon are always cool, the temperature seldom being above 60°, and owing to this cause peach propagation is confined to limited areas. The cold of winter experienced east of the Cascade mountains prevents certain varieties of fruit from being propagated, yet extremely favorable to the more hardy fruits, which grow to a greater degree of perfection than are found in the warmer and moister climates west of the Cascades. This is more especially true as regards certain varieties of apples. Taken as a whole, portions east of the Cascade mountains, especially valleys along the Columbia and Snake rivers, and some of their tributaries, better fruit sections are found than in any other portion of the state. There are, however, a few sections in this state where fruit is not now growing, or cannot grow, and which do not produce the most prolific crops.

In years past the cereals have been the main crop of the state, but the time is rapidly approaching, and will be present within five years, when Oregon will be known as one of the greatest fruit states in the union. This is due entirely to the favorable climatic conditions, and as various climates are especially favorable for certain varieties of fruit, these special climates and their relation to that special variety of fruit must be studied in order that the greatest commercial value may be obtained. There are many things to be taken into consideration in the study of surrounding conditions before the orchard is planted. The slope of the hills, their height, the character of the soil, the surrounding trees, the prevailing winds, their location relative to the sunshine, must all be considered in order to obtain the best results. Radiation proceeds from hills, valleys, and table lands, at times varying according to their position. Owing to radiation, the air, in contact with declivities of hills and rising ground, becoming cooled, acquires a greater density, hence accumulates on the low-lying ground. It follows, therefore, that fruit on rising ground is never exposed to the full intensity of frosts or cooler air at night; and the higher they are situated relative to the immediately surrounding district the less are they exposed, since their relative elevation provides a ready escape downward of the cooler air almost as rapidly as it is produced. On the other hand, valleys surrounded by hills and high grounds not only retain their own cold or radiation, but also serve as reservoirs for the cold heavy air which pours down upon them from neighboring heights. Frosts are most severely felt in those localities where the slopes above them are destitute of vegetation; if, however, the slopes be covered with trees, the temperature is warmer at the base and up the sides. The beneficial influences of forests consists in obstacles they offer to the descending currents of cold air, and in distributing the cold produced by the radiation through a stratum of the atmosphere equaling in thickness the height of the trees.

Water absorbs heat, as does soil; radiation from the latter is more rapid

than the former, hence that section of land immediately adjoining water will have a higher night temperature than the land further removed, as the warming influence of the water is exerted and shown on the adjacent land. Sites on hillsides, the tops of which are timbered with a southern exposure, are perhaps best for orchards, and best protected from the light frosts of early spring and early autumn. The successful horticulturist in seeking a new location must thoroughly understand the fruit he desires to produce, and knowing that he must then thoroughly understand the soil in which he desires to set his trees and the climatic conditions surrounding through the medium of the United States weather bureau. Observations have been made of the temperature and moisture in all parts of the state, and these observations are readily obtainable by application to any weather bureau office in the United States, so that there is no excuse any more for a man setting out an orchard and having it fail due to the climatic conditions. After a favorable location is selected, and the trees planted, the weather bureau information concerning the favorable changes will be found to be of the utmost advantage in protecting a growing orchard and fruit, and in enabling the producer to properly harvest his crop.

Oregon is peculiarly free, as a rule, from damage by frost. There are many records of minimum temperature of 32°, and yet no injury to fruit bloom or to tender plants. The reason for this is that fog is prevalent over the greater portion of the state for a few hours in the morning at the period of the year when frost is probable. The air temperature falls to about 40° by 9 p. m., and all indications point to frosts; by midnight frost is everywhere visible on boards, thick enough to permit sliding; about 4 a. m., when the first signs of day appear, the temperature is at the freezing point, and a mist gathers, first on the lower levels, gradually increasing, becoming more and more dense; by 7 a. m., the fog has permeated everything and it begins to dissolve, disappearing about 10 a. m. Such is nature's system for giving protection to fruit bloom and tender vegetation. If it was not for this phenomena Oregon would not be the great fruit country that it is. Nature is constantly assisting man in his various undertakings, and this is one of the most prominent forms in which man is assisted in Oregon. The smudge, the spraying and the irrigation of orchards when frost is probable, is expensive, and not always certain to produce the desired results, but it is unusual for fog not to appear when frost has formed or is probable. As a rule, fruit is borne so heavily by the tree, bush, plant or vine that hand-pruning of the fruit is necessary in order that the tree may be protected from breakage and the fruit be of good size and flavor, so that frost is welcomed that the expense for hand-pruning may be saved. Frost is rarely an injury to fruit in Oregon, but, on the other hand, is usually a benefit.

Owing to the competition in fruit-raising, the grower who can market his fruit first is the one obtaining the highest price. This being a fact, it be-

comes necessary for the successful fruit-grower to have his orchards, beds or fields in those locations where the greatest heat prevails from April to July; the heat must be as continuous as possible, for warm days and cool nights makes growth then checks it. This is as injurious to plants and trees as to the human life. The entire Pacific northwest has comparatively cool night temperature, hence those sections having the highest night temperature are the ones where fruit-growing will be found to be the most profitable. These sections are usually found in those regions where the soil is the lightest. Humus soils absorb heat more slowly and the radiation is less rapid than in light or sandy soils; hence the importance of selecting the proper soil. Fruit-growing has risen to the dignity of being recognized as a science; it has always been one, but has not been generally recognized as such. To be successful, weather and soil conditions must be studied and understood. Then the variety of fruit must be adapted. The United States department of agriculture has a bureau for the study of the weather and a bureau for the study of soils, hence the valuable aid the scientific branches of the government is to the producer.

Sufficient data has been collected and experiments made to demonstrate the superior conditions in Oregon for fruit culture. The industry is in its infancy. Great possibilities are in store for those who grasp the valuable assistance so generously given by nature to the fruit interests of Oregon.

In this connection it may be of interest to append the following table, showing the dates on which fruits and vegetables mature:—

Peaches and plums	From June 22 to August 15
Apples	From June 15 to October 15
Pears	From July 20 to October 30
Cranberries	October 1
Radishes	From April 7
Strawberries	From May 1 to December 1
Cherries	From May 15 to September 15
Raspberries	From June 1 to August 15
Blackberries	From June 1 to October 15
Tomatoes	From July 15 to November 1

The foregoing will give a general idea as to the dates on which fruits mature. A more careful study of cause and effect will undoubtedly develop the fact that many products not now produced will most vigorously thrive. In a brief article it is difficult to enumerate the various conditions which must be understood to be of benefit to the fruit-grower, but when the same intelligence and the same activity and the same understanding of conditions are applied to fruit-growing that is necessary for the professional men in other walks of life to apply to their calling, then will the fruit interests, not only of Oregon, but of every state in the union, be more remunerative to the grower, and intelligent application of all facts which have been deduced is beneficial to one pursuing a horticultural pursuit or any other pursuit in life.

SUGGESTIONS CONCERNING FROST.

By S. M. BLANDFORD, observer weather bureau.

Knowledge concerning the conditions under which frost forms, and the practical methods of preventing the same, are as essential to success in horticultural work as a knowledge of the chemical properties of the soils favorable to plant growth.

The conditions favorable to the formation of frosts are simple. Anyone without a technical knowledge of physics can understand the simple rules under which the aqueous vapor of the atmosphere is deposited in the form of dew or frost, and, by forethought, applying the knowledge thus obtained in a manner which will contribute largely to success in the cultivation of plants, or prevention of injury to bloom.

Through the direct rays of the sun during the warm portion of the day, the objects on the earth's surface are heated to a temperature higher than the surface air, and as the capacity of the air for retaining moisture increases with a warmer temperature, the water vapor present in the atmosphere will not condense upon the objects on the earth's surface, nor will the cooling of the surface air cause condensation while the objects have a higher temperature. With the decline of the day the sun's heat diminishes and the objects begin to throw off or radiate the heat received during the day. By the natural process of cooling, the temperature of the objects is lowered to the point of saturation. At that moment the vapor of the atmosphere begins to condense upon them, forming dew. Frost is formed by the same process, requiring only that the object shall attain a temperature below the freezing point, or 32°. Since the cooling of the objects through radiation is the process by which frost is formed, it would be well to examine the conditions favorable to perfect radiation. Cloud, smoke and shade are detrimental to perfect radiation, consequently will deter the formation of frost. The most perfect condition for the formation of frost is a clear sky with the wind calm. With the sky clear and a fresh breeze blowing, frost will not likely occur, since the influx of fresh air absorbs the moisture as rapidly as it is deposited upon the object. The most prevalent method of frost prevention and one which has been successfully tried in nearly all portions of the United States, is the making of smudge fires, by which a veil of smoke is made to extend over the district where frost is likely to occur. This method has been pursued with great success in the

tobacco-growing sections of Maryland and Virginia. In level countries frost prevention by means of smoke has proved most effective. The results are uncertain in the valleys which are skirted by high hills or mountains, since the cold atmosphere of the higher elevations flows down the incline, gradually displacing the warmer atmosphere of the valleys and producing frost, notwithstanding the presence of smoke.

For this reason plants and fruit trees growing on slopes are less liable to injury by frost than those in the valleys. There are thousands of old straw stacks in every section of Oregon in a state of decay, and worthless, that could be used to great advantage in building smudge fires. Wet straw makes the best smoke. Should the decaying straw be utilized in this manner, there is no doubt of the increase of wealth to the state that would result therefrom. Straw heaps should be placed in convenient places about the fields, ready to be started upon the slightest appearance of danger of frost occurring. It should be known that the national weather bureau has provided the voluntary meteorological observers of the several states with tables of dew-points and relative humidity. In Oregon there are about 60 observers of the Oregon state weather service so provided. An extract of those tables which would likely be used during the frost seasons is appended.

By dew-point is meant the temperature to which it would be necessary for an object to cool so that the vapor of the atmosphere would condense upon its surface. By relative humidity is meant a "convenient term" for expressing the amount of moisture which the air should contain. "When the air is saturated with aqueous vapor it is said to contain 100 per cent."

To ascertain the dew-point or probable temperature to which objects will likely cool, it is necessary to be provided with two good thermometers. Cover the bulb of one with muslin; insert the covered bulb or wet bulb thermometer in clean water until the muslin is completely saturated; attach a strong string to the wet bulb thermometer and whirl rapidly in the air, taking frequent readings to determine the lowest reading; then read the dry bulb thermometer and take the difference between the readings of the dry and wet bulb thermometers. Refer to the table to ascertain the dew-point. Follow down the column until a temperature corresponding to the reading of the dry bulb is reached, then to the right until arriving at the column corresponding to the difference between the readings of the dry and wet bulb thermometers; the number at the intersection of the columns will be the dew-point.

Dew-point tables in use by the voluntary meteorological observers of the United States :—

TABLE I.

Temperature of the dew-point, in degrees, Fahrenheit.

t Dry thermometer.	Difference between the dry and wet thermometers $(t-t')$. $0°\cdot5$	$1°\cdot0$	$1°\cdot5$	$2°\cdot0$	$2°\cdot5$	$3°\cdot0$	$3°\cdot5$	$4°\cdot0$	$4°\cdot5$	$5°\cdot0$	$5°\cdot5$	$6°\cdot0$	t Dry thermometer.
40°	39	38	36	35	34	33	31	30	29	28	26	25	40°
41	40	39	37	36	35	34	32	32	30	29	28	26	41
42	41	40	39	38	36	35	34	33	31	30	29	27	42
43	42	41	40	39	37	36	35	34	32	31	30	29	43
44	43	42	41	40	38	37	36	35	33	32	31	30	44
45	44	43	42	41	40	39	37	36	34	33	32	31	45
46	45	44	43	42	41	40	38	37	36	35	33	32	46
47	46	45	44	43	42	41	40	39	37	36	34	33	47
48	47	46	45	44	43	42	41	40	38	37	36	35	48
49	48	47	46	45	44	43	42	41	39	38	37	36	49
50	49	48	47	46	45	44	43	42	41	40	38	37	50
51	50	49	48	47	46	45	44	43	42	41	39	38	51
52	51	50	49	48	47	46	45	44	43	42	41	40	52
53	52	51	50	49	48	47	46	45	44	43	42	41	53
54	53	52	51	50	50	49	47	46	45	44	43	42	54
55	54	53	53	52	51	50	49	48	47	46	44	43	55
56	55	54	54	53	52	51	50	49	48	47	45	44	56
57	56	55	55	54	53	52	51	50	49	48	47	46	57
58	57	56	56	55	54	53	52	51	50	49	48	47	58
59	58	57	57	56	55	54	53	52	51	50	49	48	59
60	59	58	58	57	56	55	54	53	52	51	50	49	60
61	60	59	59	58	57	56	55	54	53	52	51	50	61
62	61	60	60	59	58	57	56	55	54	53	52	52	62
63	62	61	61	60	59	58	57	56	55	55	54	53	63
64	63	62	62	61	60	59	58	57	56	56	55	54	64

TABLE II.

Temperature of the dew-point, in degrees, Fahrenheit.

t Dry thermometer.	*Difference between the dry and wet thermometers* $(t - t')$.													t Dry thermometer.
	6°·0	6°·5	7°·0	7°·5	8°·0	8°·5	9°·0	9°·5	10°·0	10°·5	11°·0	11°·5	12°·0	
40°	25	23	22	20	18	16	13	11	8	4	------	− 5	−12	40°
41	26	25	23	21	20	17	15	13	10	7	+ 4	− 1	− 6	41
42	27	26	24	23	21	19	18	15	12	10	7	+ 3	− 2	42
43	29	27	26	24	23	21	19	17	14	12	9	6	+ 2	43
44	30	28	27	26	24	22	20	18	16	14	12	9	6	44
45	31	30	28	27	25	24	22	20	18	16	13	11	8	45
46	32	31	30	28	27	25	24	22	20	18	16	13	11	46
47	33	32	31	29	28	26	25	23	22	20	18	15	13	47
48	35	33	32	30	29	28	26	25	23	21	20	17	15	48
49	36	34	33	32	31	29	28	26	25	23	21	19	17	49
50	37	35	34	33	32	31	29	28	26	24	23	21	19	50
51	38	37	36	34	33	32	31	29	28	26	24	22	21	51
52	40	38	37	36	34	33	32	30	29	28	26	24	23	52
53	41	39	38	37	36	34	33	32	30	29	28	26	24	53
54	42	41	40	39	37	36	34	33	32	30	29	27	26	54
55	43	42	41	40	39	37	36	34	33	32	30	29	28	55
56	44	43	42	41	40	39	37	36	34	33	32	30	29	56
57	46	45	44	42	41	40	39	37	36	35	33	32	30	57
58	47	46	45	44	42	41	40	39	37	36	35	33	32	58
59	48	47	46	45	44	43	41	40	39	38	36	35	33	59
60	49	48	47	46	45	44	43	41	40	39	38	36	35	60
61	50	49	48	47	46	45	44	43	42	41	39	38	36	61
62	52	51	50	49	48	47	45	44	43	42	41	39	38	62
63	53	52	51	50	49	48	47	45	44	43	42	41	39	63
46	54	53	52	51	50	49	48	47	46	45	43	42	41	64

TABLE III.

Temperature of the dew-point, in degrees, Fahrenheit.

t Dry thermometer.	Difference between the dry and wet thermometer ($t - t'$).													*t* Dry thermometer.
	12·0°	12·5°	13·0°	13·5°	14·0°	14·5°	15·0°	15·5°	16·0°	16·5°	17·0°	17·5°	18·0°	
40°	−12	−22	−44	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	40°
41	− 6	−13	−25	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	41
42	− 2	− 7	−15	−28	-----	-----	-----	-----	-----	-----	-----	-----	-----	42
43	+ 2	− 3	− 8	−17	−13	-----	-----	-----	-----	-----	-----	-----	-----	43
44	6	+ 1	− 4	−10	−19	−40	-----	-----	-----	-----	-----	-----	-----	44
45	8	5	0	− 4	−11	−22	−48	-----	-----	-----	-----	-----	-----	45
46	11	8	+ 4	0	− 5	−13	−24	-----	-----	-----	-----	-----	-----	46
47	13	10	7	+ 3	− 1	− 6	−14	−27	-----	-----	-----	-----	-----	46
48	15	12	10	6	+ 2	− 2	− 8	−16	−30	-----	-----	-----	-----	48
49	17	14	12	9	6	+ 2	− 3	− 9	−18	−35	-----	-----	-----	49
50	19	16	14	12	9	5	+ 1	− 4	−10	−20	−42	-----	-----	50
51	21	18	17	14	11	8	5	0	− 5	−12	−22	−52	-----	51
52	23	21	19	16	14	11	8	+ 4	0	− 6	−13	−25	-----	52
53	24	22	20	18	16	14	11	8	+ 4	− 1	− 6	−14	−28	53
54	26	24	22	20	18	16	13	10	7	+ 3	− 2	− 8	−16	54
55	28	26	24	22	20	18	16	13	10	7	+ 3	− 2	− 8	55
56	29	27	26	24	22	20	18	15	13	10	6	+ 2	− 2	56
57	30	29	28	26	24	22	20	18	15	13	10	6	+ 2	57
58	32	30	29	27	26	24	22	20	18	15	12	9	6	58
59	33	32	31	29	27	26	24	22	20	18	15	12	9	59
60	35	33	32	30	29	27	26	24	22	20	18	15	12	60
61	36	35	33	32	31	29	28	26	24	22	20	18	15	61
62	38	37	35	34	32	31	29	28	26	24	22	20	18	62
63	39	38	37	35	34	32	31	29	28	26	24	22	20	63
64	41	39	38	37	35	34	32	31	29	28	26	24	22	64

The regular stations of the national weather bureau obtain the result in like manner by use of an instrument called the "whirling psychrometer." The national weather bureau numbers among its duties the reporting of the condition, growth and progress of crops from the time the seed is sown until the harvest is complete. Careful study is given to fruit bloom and the conditions which affect them. A forecast official of the national weather bureau is stationed at Portland, Oregon. His forecast territory embraces the states of Oregon, Washington and Idaho. He carefully studies the conditions under which frost occurs and has authority to telegraph forecasts to certain designated places. Some of the places to which forecasts are telegraphed, having good railroad facilities and provided with displayman, send out the warnings on the trains by means of cards addressed to station agents. These cards are displayed at the railroad stations, others are sent to postoffices. In this manner five hundred or more forecast cards are distributed daily in Oregon. It is the constant endeavor of the officials of the Oregon climate and crop service to acquaint the people of Oregon with the character of work in which they are engaged.

THE APPLE.

By Hon. H. B. Miller.

Every agricultural production requires a careful examination of three fundamentals: Markets, soil and climate.

Markets: Of these three the Oregon apple-grower is seriously handicapped in the matter of markets.

There is no apple section of the United States or Canada where the cost of getting to market is as great as from Oregon. The great apple consuming population of the country is much nearer Michigan, New York, Kansas, Missouri, New Mexico and Colorado than we are, and even Washington and Idaho for some reason secure much better rates to the eastern markets than Western Oregon, and in addition to that have a fair market in the mining districts surrounding them.

The great barrier to the profitable production of apples in Western Oregon is the matter of cost of reaching the market. In this respect prune-growing has a great advantage over apple-growing, as the prune-grower of Western Oregon is on a par with any other prune district of this country, and in Italian prunes the Oregon producer has the field largely to himself.

The greatest objection to the production of apples in Western Oregon, so far as I can discover, is in the expense of reaching the market. If we are always to pay the highest transportation it is clearly evident that apple-growing will be subject to great fluctuations in the profit and loss account. Profits will come only during years of short crops in the principal apple districts. This will have a tendency to restrict the production of apples. A single season of a loss with a good crop will so discourage the average grower that he will allow fungus, scale, scab and moth to ruin his orchard, as they can sometimes in a single season.

A man who has not the courage to withstand several seasons without profit after his orchard is in bearing ought not to plant apples.

How may we overcome this disadvantage of extra market cost?

First—The railroads having good apple districts along their lines should aid the growers during years of a general large crop by cheap rates.

Second—The grower laboring under the difficulty of excessive transportation must produce only choice fruit. The very best fruit is the only kind that will bear this highest transportation.

I do not consider it advisable for anyone to engage in the production of

apples unless they feel assured that they can produce the very best. A fancy, four-tier, highly-colored, good-flavored apple will, I think, bring a profit, and it is about the only class that will be profitable to the Oregon grower in the future. We hear so much about the past fame of our big, red, Oregon apples that we are in danger of thinking that no other country can equal us in the production of apples. The many new apple-growing districts of Missouri, Kansas, Arkansas, New Mexico, Washington, Idaho, Colorado and California, however, are truly marvelous in quantity and quality of their productions.

Looking into the future there seems to be a bright prospect for the apple-grower in the coming expected development of Asia. Should that country have the growth that we now have reason to expect, by the time that orchards come into bearing that are planted at this time, there will in all probability be a market there for all the good export apples that Oregon will produce. In this market we would have the advantage. If we are to reap this advantage, we must plant largely such varieties as will bear up under ocean transportation.

Soils.— Upon this subject there is a great difference of opinion. Much is being argued in favor of hill land. There has been a serious mistake all over this state in the matter of proper soils for orchards, and it is common to hear persons, when discussing value of soils, to refer to poor, hill lands as "good enough for orchards."

While I would not undertake to say that some of the deep, rich, hill soils would not be good apple and fruit land, I think I can say truthfully that the best peach, prune, apple and pear orchards in Oregon are on rich, alluvial, bottom lands.

As for apple land, I am thoroughly convinced that there is no better soil to be found than the warm, sandy, alluvial deposit along the various rivers.

In relation to soil for apples two propositions are so well established that they seem to admit of no controversy, viz., the soil must have good depth and be well drained. To this might be added still another primary factor, and that is, the soil must also be rich. More apple trees have died in Orgon from wet feet than from any other cause.

Shallow soil is, I think, the next great cause of failure of apple orchards. It is therefore advisable before planting an apple orchard to prepare a plot of the subsoils by boring with a two-inch auger. Unless there are eight feet of good soil, well drained, it would hardly be advisable to plant it to apples.

In addition to having ascertained the physical conditions of the land, it would also be a very good policy to have the chemical constituents determined. The best apple trees cannot be grown on a soil deficient in lime.

In addition to the elements required for the production of a vigorous tree, one acre of apple trees producing 15 tons of apples must take from the soil 39 pounds of nitrogen, 60 pounds of potash and 30 pounds of phosphoric

acid, hence these elements must be provided by the soil or fertilization will be necessary. Soils well supplied with all these elements, in good physical condition, can be depended upon to produce good apples.

While some varieties of apples will thrive on lighter and poorer soil than others, I consider it advisable to put every variety on the best land to be had. The best hop land, as a rule, is good apple land. The best grain land, however, is not necessarily the best apple land. In fact, some of the best apple orchards that I have seen grow upon land that produces wheat very poorly.

Climate.—The matter of climate is growing to be of more importance in the selection of a location for apple-growing as pests and disease increase. It is of primary importance in the matter of color for the apple. No parts of California, except the mountain districts, can produce a highly-colored, red apple. All of the red apples grown in the valleys have a pale and sickly color, and even when grown near the coast they lack the lively and rich color of the Oregon red apples. Western Oregon seems to have just the proper climatic conditions for the production of the finest type of the red apple, both in size and color. The Yellow Bellefleur, the Yellow Newtown and the White Winter Pearmain have become the leading California apples, because of their inability to produce the red varieties in perfection. Outside of the Yellow Newtown it is observed that eastern buyers always prefer our red varieties.

Moss, scab and other fungus growths make apple-growing in Western Oregon more difficult than in other sections, and adds to the difficulty of keeping down scale and codlin moth, especially in old orchards.

In these respects, as well as that of having more lime in the soils, Eastern and Southern Oregon present advantages over the Willamette valley. The drier character of soils and climate of Southern and Eastern Oregon will hardly produce the brilliant red-colored apples of the Willamette unless irrigation is added. The great new apple districts of New Mexico and Colorado produce highly colored, fancy fruit only by irrigation, and I am inclined to the opinion that Eastern and Southern Oregon could produce a better colored and little higher classed apple if irrigation was resorted to in August and September.

Our state is full of almost every known enemy of the apple. Scab, scale, canker and others are to be found almost everywhere, and many valuable orchards are annually being destroyed by these pests. Unless more rigid methods of extermination are employed, apple-growing in Oregon will soon be too expensive to be profitable.

VARIETIES.

The question of what kind to plant is one of market, soil and climate.

The Baldwin and Spitzenbergs seem to do well in the Willamette. These varieties are not good keepers in the Rogue river valley, as they mature during the warm season.

The Jonathan I look upon as a profitable apple, and a very good one for the main part of the state. It does remarkably well in the Willamette valley.

Should our market in the islands and across the Pacific develop, as we now have reason to expect, the Yellow Newtown, Winesap and Ben Davis will all be in demand, because of their keeping and shipping qualities.

The markets in and across the Pacific are worthy of careful study by anyone planting apples.

For the Willamette valley apple-grower there is another feature of the market that it would be wise to examine. For several years nearly all the apples planted have been the best keepers. The fall apple has been neglected, and it is not an easy matter to supply the demand. The western part of Oregon, with its cool summers, produces as fine a fall apple as can be grown anywhere. The Gravenstein is as good an apple as can be grown for that trade, and, I believe, will be very profitable.

A large commercial apple orchard in Western Oregon should contain a good proportion of fall apples, some early winter, midwinter and late keepers. An orchard of this kind, if planted on proper soil and well cared for, would no doubt prove profitable. Market, soil and climate are the primary subjects of investigation.

There ought to be no trouble about varieties, for an examination of the fruit grown in each locality is the best guide. The successful apple-grower must measure the markets of the future, study his environment in the matter of production with the broadest observation of soils, pests and climate, and he must become a close student of nature and grow in the knowledge of its laws until it brings him abiding faith. Added to this, he must be a man full of pluck, energy and honesty. I do not believe it possible for a dishonest man to make a permanent success in the production and marketing of apples. He must be honest and fair with nature to produce good fruit. Should he undertake to cheat in production his fruit will be worthless. Should he try to deceive the buyer and consumer, his market will be destroyed.

Apple-growing has in its path many disappointments, but in the end it will bring a fair reward for intelligent, energetic and honest effort.

Some one asks "Won't the market be overdone?" Of course it will; all markets are overcrowded. You cannot find any occupation where everyone is making a profit. Some are losing, some are at a standstill and some are making profits.

The question to determine in apple-growing is the same as in any other line of production, viz: Have you the elements under your control for the production of fine apples at the lowest cost? If you have, then it would be wise to undertake it; but if you cannot produce the best apples at the lowest cost do not undertake it, for you will be sure to fail.

THE PEAR.

By Prof. George Coote.

The pear (*Pyrus communis*) is a native of England as well as most parts of Europe and Western Asia.

It attains a greater height than the apple and generally assumes a more pyramidal form of growth. Under favorable circumstances it lives to a great age, in some instances upwards of four hundred years. It was cultivated more than three thousand years ago by the Greeks and Romans. It is supposed to have been introduced by the latter into Gaul and from thence into England. Many of our best varieties have been introduced into America from France, Germany and England. Take the well-known Bartlett. It was originated in Berkshire, England, about the year 1770, and was introduced by a Mr. Williams, a nurseyman near London, under the name of Williams Bonchretien. It was imported and first grown in this country by Enoch Bartlett, of Dorchester, Massachusetts, who lost the name under which it was sent to him. Mr. Bartlett received it about the year 1799, and it was sent out by him under the present name. This variety adapts itself to almost any location and is one of the most extensively propagated varieties known.

Propagation.—This is effected by seed for obtaining new varieties, but for general purposes budding and grafting. For the latter good healthy stocks should be had. On this depends a great deal the healthfulness of the trees. If stock is weak and sickly the trees will be more or less diseased. The pear stock is unquestionably the most natural for the pear. On it consequently the tree possesses the greatest vigor and attains the greatest age. Seed saved from the Pound pear produce excellent stock for working standard trees and strong growing varieties upon.

Treatment of stock.—The seedling should be taken up at the end of the first year and reset, but before resetting the plants should be sized, placing all strong growing plants together. All those with a crooked habit should be rejected. Those of a secondary degree of vigor will furnish much better plants in rows by themselves than if they were mixed with those that are stronger.

Quince stock.—It will be understood that the quince is a very shallow-rooted plant, and care must be taken not to cultivate so deeply as the pear stock, as too deep cultivation would damage the roots, therefore, by so

doing would give the trees a setback instead of encouraging large growth. The advantages offered by the quince as a stock for the pear are, as compared with the pear stock, a more dwarf growth of the tree, as well as shallower root action, earlier bearing and sometimes the fruit is larger and better matured. Owing to the shallowness of the roots of the quince they are better adapted to thin soils. Also, where the subsoil is unfavorable to the growth of the pear stock, canker often sets in ; but if quince stocks are used on these unfavorable soils the disease will be considerably less. Not only is the disease lessened, but the fruit will be of a better color than on the pear stock, and as already alluded to above, it is sometimes larger. This increase in size and color is owing to the partial check which the sap receives in cold situations ; and in damp soils, into which the pear stock would penetrate and draw colder sap than would be congenial for nourishing the fruit, the quince stock may be advantageously substituted.

Varieties suitable for working on the quince are as follows : Bartlett, Beurré Easter, Beurré d'Anjou, Fall Butter, Duchesse d'Angoulêmn, Vicar of Wakefield, Beurré Clairgean and Madeline.

Varieties that do better on the pear : P. Barry, Sheldon, Seckel, Mount Vernon and Le Conte. I report those only that I have experimented with.

Soil.—Such varieties as are grown on the pear stock require a deep, loose, sandy loam, well drained, so that no water stands about the roots.

Pruning.—The stems of standard trees may be headed down to suit the judgment of the cultivator; but whether high or low standards are required, the same mode of pruning will be needed to form a perfect head. To accomplish this three shoots must be obtained at the desired height, these shoots constituting the three main limbs, and each of these should be cut so that two shoots may be produced at from nine to twelve inches from its base. Six main branches will be produced, a number quite sufficient for several years. All shoots produced from the principal branches should be kept subordinate until the latter have diverged so far as to afford abundant space for an intermediate branch. Where space permits of a greater number of branches they may be produced at any point by cutting back at suitable buds at that place. Usually three buds will be produced immediately below the section, but in case of standards and dwarfs, three branches, with the exception of three main limbs, should never be produced from the same point. Where three branches, tridents, make their growth, one of these should be cut off closely or shortened back, so as to form a spur.

Varieties worked on the quince stock are better adapted to soils having a clay subsoil that is inclined to be over-moist, but even where the latter stock is used drainage must not be neglected if the best of success is looked for.

Pollination.—Many of the varieties of pears are incapable of self-fertilization, therefore it is essential that several varieties should be planted in

one orchard. This mixing up of varieties will be found to be very beneficial in the matter of the fruit setting, also the fruit will be of large size and better form. In order that the very best results may be had from cross-pollination such varieties should be planted together that open their bloom at the same time. For this purpose the following varieties will be found to answer well, grouped as follows:—

1. Duchesse d'Angoulême, Beurré Easter, Beurré Clairgean, Beurré d'Anjou and Fall Butter.

2. Winter Nellis, Pound Pear (a few trees of the latter may be planted with the former for pollination purposes only).

3. P. Barry, Seckle.

4. Bartlett, Louise Bonne de Jersey.

Pollen from Beurré Easter produce the finest fruit when cross-pollenized with other varieties.

THE PEACH IN SOUTHERN OREGON.

By W. B. Colton.

While much has been written concerning the planting, cultivation and marketing of peaches, recognizing the fact that climate, soil and moisture are potent factors in its successful production, I hereto append a brief epitome of the methods found to be the most successful in the region usually denominated "The Rogue river valley," in Southern Oregon.

LOCATION OF ORCHARD.

In selecting site for a peach orchard four considerations are of paramount importance, viz., incline, soil, altitude and drainage. There is a diversity of opinion as to incline, some contending that a northerly slope is the better, while others having equally good success favor an easterly incline of surface; but it can be safely assumed that with other satisfactory requisites, either of such inclines will prove satisfactory and successful. By no means choose a westerly or southerly incline. The soil proven the best is a fine granite, underlaid with clay subsoil; this clay subsoil being a great conserver of fertilizer and moisture, two very important items in this climate.

The altitude most desired is in what is called the thermal belt, which is medium with relation to the lowest and highest surface surrounding. Never choose a flat, low site, as such locations are very subject to late frosts in the spring and very early ones in the fall.

PREPARING THE GROUND FOR PLANTING.

After selecting the site, the next in order will be to prepare the ground for planting. Assuming the land to be already cleared, plowing of surface in the fall, as soon as rains furnish moisture sufficient, comes first, with subsequent harrowing. After enough rain has fallen and the surface soil be sufficiently dry to work, a second plowing followed by subsoil plow breaking the subsoil eight or ten inches deeper than surface plowing is very desirable, the breaking of the subsoil furnishing a reservoir for the moisture supplied by subsequent rains. It is very important that the subsoiling be done early enough in the season that there may be rains following sufficient to thoroughly saturate the subsoil thus broken up. Then harrow thoroughly to make surface as fine as if to be planted to corn.

Many persons naturally conclude that a good incline of surface produces good drainage, but this does not necessarily follow, as has been experienced by the writer. When the necessary drainage is not furnished by the slope of the surface it must be supplemented by laying tile where needed.

PLANTING TREES.

Trees designed for planting should never be more than one year old from the bud, and the medium size is better than the extra large, although a thrifty, bright tree is much better than one having the appearance of being stunted in its growth. Purchase these from a reliable grower, and grown in dry soil without irrigation, if possible.

Having properly prepared the ground and purchased your trees, the next thing in order will, of course, be the planting of them. Do not attempt this until the soil is in proper condition for working. If in good condition for planting corn or potatoes it is all right for planting trees. I should have previously stated that when the trees arrive from the nursery, assuming that they have been shipped, the bundles should be opened, the trees separated and heeled in to prevent heating, moulding or the sprouting of fibrous roots.

Now, mark your ground with the plow, if it can be done straight, each way, making the rows sixteen feet apart. The trees should be prepared for planting by carefully pruning the roots, cutting back all bruised or broken roots to where they are sound, and leave none more than six inches in length. Cut off all branches, leaving the center full length. Scoop out the hollow at each crossing and place your tree, carefully filing compactly all spaces between roots so that air cannot penetrate and dry them out. See that the trees line perfectly each way. When all are planted, cut the main stem off at a uniform height from the ground, leaving them not more than eighteen inches high.

STARTING THE TOP.

As soon as growth begins in the spring, select three or four buds near the end of the stem to form the future head of the tree, and rub off, and keep rubbed off, all other shoots that start from the stem. If one of these shoots seems inclined to take the lead of the others in the first summer's growth, it should be pinched at the tip so that it can be overtaken by the others and a well-balanced head started. The next winter's pruning will consist in cutting back the shoot made the first year one half, pruning to a bud on the outside so as to continue the open and spreading form of the head. The growth that comes toward the center of the tree this summer should be thinned by rubbing out shoots, as soon as they appear, which are not wanted.

During the first three years of a peach orchard from planting any hoed crops may be grown between the trees. Plow the ground as deep as needed

ORCHARD SCENES IN SOUTHERN OREGON.

for the crop, taking care not to plow so close to the tree as to disturb any of the roots nor bruise the body; afterwards, with spading fork, carefully work the ground of the unplowed squares. It is very desirable, at all times, to keep the surface of the whole orchard as smooth and even as possible. Do not plant crops that need irrigation, as it is best that trees should make growth unstimulated by artificial moisture. Endeavor to supply all moisture needed by thorough cultivation.

The third or fourth year from planting the trees should produce a small crop of fruit. Care must be taken to severely thin the fruit after forming that it may not over-produce, thereby injuring the tree for future crops. I think one of, if not the greatest error committed by all peach-growers, is neglecting to properly thin the fruit. As no rule can be laid down for the proper doing of this, experience must be the teacher. I will only say that I have never seen fruit thinned too much when done by hand, the object of this thinning being two-fold, viz., to produce only the best fruit for market and to conserve the vitality of the tree.

After the tree arrives at the age of eight years it should be capable of producing from six to eight boxes of twenty pounds each to the tree. But do not make it the aim to get big crops so much as to produce the finest fruit. When the tree arrives at maturity and is capable of producing full crops irrigation may be resorted to for supplying the great demand for moisture necessary for properly maturing the fruit. But care must be taken that this be not overdone and in consequence spoil the flavor of the fruit. There is no one feature of growing the peach in Southern Oregon that requires greater judgment and care than this.

There is great diversity in pruning the tree after attaining full growth, and no rule but a general one can be laid down that will properly apply to all locations and conditions.

Several objects desired to be secured are as follows: *First*—A low head to the tree thereby greatly facilitating the gathering of the fruit, and also for the benefit of the tree in preventing to a great degree the loosening of the roots or the inclining the body of the tree by the action of the wind. *Second*—Sunlight on the fruit to produce fine color which can be only attained by properly thinning the branches throughout the tree. It is desirable to have fruit distributed as nearly equal over the tree as possible.

VARIETIES TO GROW.

Nearly all known varieties succeed in this locality and therefore the varieties to be selected should be determined largely by the demands of the market in which they are to be sold. The varieties most extensively grown here are the Hale's Early, Crawford, early and late; Muir, Elberta, Twenty Ounce Cling, Golden Cling, Smock's Late, and Salway. Instead of planting each variety in solid blocks, I would alternate rows of different varieties, thereby securing the benefit of cross-fertilization of the bloom.

PICKING AND PACKING.

This requires the best judgment, coupled with experience. The fruit should become fully matured and yet not soft in any part. It should be carefully picked and laid (not thrown) into the basket used for that purpose. The baskets of fruit should then be carefully conveyed to the packing house. There the fruit should be carefully wrapped in the fruit paper provided, each peach singly, grading them so as to place each as near uniform in size as practicable. Do not pack any culls or bruised fruit, as the culls will fix the price of the whole box, and a bruised peach would not only become worthless in transit, but would very likely injure the fruit surrounding it. Press closely, but do not overdo the pressing so as to bruise the fruit; have the cover when nailed on press firmly. The object to be attained being to have the fruit so firmly placed that it will not jostle when handled. Mark your boxes with the variety of fruit it contains and also the grade as to size, A, B, C, etc.; also your name and place of residence with a neat rubber stamp. An attractive lithograph label pasted on each box will pay the shipper, provided always, the fruit contained in the package upon which it is placed is choice, otherwise it only advertises brands to be avoided.

Insect pests and fungus diseases affecting the peach have been so thoroughly treated by bulletins issued and circulated by the state agricultural college and horticultural commissioners, that a repitition here is unnecessary.

GRAPES IN THE WILLAMETTE VALLEY.

By Wilbur K. Newell.

The first thing to be considered in the culture of grapes in Western Oregon is to secure the right varieties, for to the planting of unsuitable varieties is due many of the failures. The European grape (*Vitis vinifera*), of which there are some two thousand varieties, is a native of Armenia. It has been grown in Europe and Asia for thousands of years, and been tried in America ever since its earliest settlement, but has never succeeded in the open air except in California and a few places in the south. No beginner should attempt its culture in the Willamette valley, for it requires constant applications of sulphur to protect it from mildew. It is much more tender than our native grape and will be always subject to the diseases that have played havoc with the vineyards of California and Europe. Some experienced growers, in very favorable localities, have had a fair degree of success with some varieties, but the beginner should stick to our native grapes, which are in every way superior for this climate. *Vitis vinifera* is more commonly known here as the California grape, and the best known varieties are Black Hamburgh, Buckland's Sweetwater and Muscat of Alexandria. There are twenty or thirty species of our native grapes, indigenous to North America, from which have been derived some fifteen hundred varieties, of which, however, not over fifteen or twenty are suitable for general culture. I will describe only a few that have been tested in Oregon and found well adapted to the climate.

Concord stands at the head of the list, possessing more good qualities than any other grape now in general cultivation. It seems preëminently suitable for Oregon, succeeding better here even than in New York and Ohio, where it is so justly famous. The bunches are good sized and compact. Berries large, black, thickly covered with a beautiful blue bloom; skin thin; flesh moderately juicy and sweet; pulp tender, with a slight foxy flavor; vine very hardy and vigorous; leaves dark green and very thick. It is a very heavy and regular bearer. Ripens here from September 15 to October 1.

The Niagara occupies the same place among the white grapes that the Concord does with the black. It is not quite the equal of the Concord in flavor and its color is unattractive, but otherwise it is equal or superior to the Concord, being a better keeper and shipper and growing a more perfect

bunch. Bunches are large; berries large with tough green skin; pulp firm; juice moderately sweet, but with a pronounced foxy flavor and odor; ripens with the Concord. For market purposes these two grapes should comprise the bulk of the vineyard; though there are many grapes that are finer flavored than these, there are no others so profitable.

The Delaware has become a standard of excellence as regards quality. The bunch is small, but compact; berries small; skin thin and of a beautiful dark-red color; pulp tender, juicy and sweet; vine hardy and fairly vigorous; ripens early, but is neither a very heavy nor sure bearer.

The Brighton is a very fine grape. Bunch, large; berries, medium; a reddish-purple color; skin thin, pulp tender, with a very pleasant flavor. An exceptionally good keeper for a thin-skin variety. Vine, vigorous and fairly productive.

Moore's Diamond is equal to the Delaware in flavor. Bunch, medium; berries, large; skin, thin, but firm, greenish-white at first, becoming yellowish with maturity. Pulp, tender, sweet and delicious. Vine, vigorous, hardy and fairly productive. Bound to be a popular grape when the public taste is educated to appreciate quality.

The Eaton is an immense, showy grape, but of inferior quality. Bunch, large; berries, extra large; skin, thick and black. Pulp, juicy, but neither sweet nor rich. Its weak point as a market grape is its strangely tender stem, the berries breaking from the bunch at the slightest touch. This, of course, renders it impracticable to pack and ship them any distance.

The Green Mountain is an excellent very early grape. Bunch, medium; berries, medium, with greenish-white skin; pulp, very tender and pleasant. Vine, hardy and quite productive.

Moore's Early is being largely planted here of late, but it is not a first-class variety. Bunch, large and compact; berries large, with thick skin and black; pulp, tender and juicy, but not very sweet nor very rich. Vine, hardy, but in this climate seems to fail frequently to form good bunches. Ripens from September 1 to 20.

The Worden is a seedling of the Concord and difficult to distinguish from its parent. Bunch, large and compact; berry, large and black; skin, thin, with bloom. Resembles the Concord in flavor, as it does in appearance. Vine, hardy and productive. The fruit is possibly a little more uniformly fine in appearance than the Concord, but in this climate it is soft, breaking from the stem very easily, hence, is not a good market grape. It ripens five or ten days earlier than the Concord, matures quickly after beginning to color and likewise deteriorates quickly after maturity.

The above varieties are all the really desirable ones that I have personally observed and tested; and any of them planted in favorable soil and location will not fail to give satisfactory results.

Having selected our varieties, the next most important question is the soil and location. I think that most any of the red hill lands of Western

Oregon that have a southern exposure and are sufficiently high to be free from late spring frosts will do. Elevations between 200 and 1,000 feet are best, though near large rivers much lower land will be just as good. A very necessary point is to select a place where the cold air can settle to the ravine or valley below. This is a great protection against frost, and usually insures good natural drainage. If drainage is not naturally good then the land must be tiled, for a good friable sod is a necessity. The side of a hill is much better than the top as the grape needs all the sun's heat that can be secured in spring and fall. Most any soil to be found in such localities as I have described will be good; if a little rocky or gravelly all the better. Anyone that has no suitable land for a vineyard can plant a few vines against the south side of a building or high plank fence.

New land or clover sod just turned under is best, and should be deeply plowed and thoroughly harrowed. Then holes dug for each vine twenty-four to thirty inches in diameter, and sixteen to twenty inches deep, putting some of the surface dirt in the bottom of the hole. Vines should be planted in rows seven or eight feet apart and eight or nine feet apart in the row. This will require 700 or 800 vines per acre.

The best time for planting is in April, though it may be done at any time during the winter if the ground is dry enough, but it is better to wait until May than to plant when too wet. One-year-old vines are best. In planting trim off all ragged roots and cut back very long ones one half or two thirds and cut back stem to two buds. Plant deeply, working fine surface soil carefully about the roots, then trample thoroughly with the feet until the hole is nearly full, and finish by spreading the clay from the bottom of the hole loosely over the top. While planting the vine set a strong four-foot stake by its side; always on the same side and the same distance from the vine. It will then serve as an aid in planting the rows straight and will not be a nuisance when it comes time to cultivate. The ground should be kept thoroughly worked and free from weeds from early spring until about August first, when it is best to quit and let the wood ripen. The tools needed are a small plow, running shallow, and an ordinary one-horse cultivator; using a hoe if necessary. My rule is to stir the ground at least every ten days during May, June and July, always, of course, taking care not to work the ground when wet.

The pruning is the most difficult part for a beginner to understand, and must be seen to be thoroughly understood, for it is almost impossible to give clear directions, the treatment varying so with the variety, growth and method of training adopted. However, for the first year it is plain sailing. In planting leave two buds; as soon as these get long enough tie the strongest one to the stake and rub off the other one. This new shoot is very tender, and must be carefully handled, for an accident to it will mean the loss of the season's growth. Keep it tied carefully to the stake, as it grows, and pinch off all laterals as fast as they appear, in order to throw all the

strength of the vine into the straight cane. The future pruning will depend upon the method of training adopted. There are many ways, and each has its supporters, but I think the best, all points considered, is the fan-shape on a wire trellis. For this method the second spring the first season's cane should be cut back to 12 or 15 inches from the ground, and two buds left to grow; all other buds and suckers being rubbed off as fast as they appear. The third spring the trellis should be built. Plant heavy, cedar, fence posts about 100 feet apart along the rows, bracing the end ones firmly. Then, by means of a wire stretcher, stretch No. 12, galvanized wire, one at the height of 22 or 24 inches and another at 50 or 54 inches; then fill in with smaller posts or stakes every 16 feet along the row. These can be sharpened and driven with a maul, and the wires fastened to them by means of wire staples. The third spring the two branches of the second season are to be cut back to three or four buds each and tied to the lower wire, the main stem still being kept tied to the original stake until strong enough to stand alone. About four shoots may now be left to grow and spread over the wires; when they have made a growth of five or six feet pinch out the tip ends. A few bunches of fruit may be expected this year, but if a vine sets very much, some of it should be removed at once. These four canes of the third season will furnish the bearing wood for the fourth, and should be cut back in accordance with the amount of fruit desired. Now four or five new shoots must be started to furnish bearing wood for the fifth season, when the bearing canes of the fourth season must be removed. This process is so repeated every year, remembering always that the fruit is produced only upon the new wood of the year previous.

The best time for winter pruning is in February, though it may be done earlier, but in case of a severe freeze there is then danger of the end buds being damaged. No pruning of the old wood should be done after growth has started in the spring, though many good authorities say that the bleeding does no damage; it certainly does no good, and it is best to be on the safe side and prune earlier. Summer pruning consists of rubbing off all suckers and superfluous buds and pinching back the shoots at the proper time; the shoots for next year's wood, when they attain a growth of five or six feet, and the bearing shoots, when the fruit is set, just beyond the second leaf beyond the farthest bunch of fruit. If the vine is setting too much fruit, remove some of it.

The directions here given are based on the assumption that the vine is making a strong, vigorous growth, while of course there will always be some that are much weaker and of slower growth than the rest; these must be allowed more time, the second season cutting them again back to two buds and allowing them another year for the growth of a good, strong central cane. If anyone does not wish to go to the expense of trellising, they may just keep the central cane tied to the stake, cutting it back to a height of twenty or twenty-four inches and allowing the bearing canes to come

directly from it, every year cutting them back to one or two buds. This is much less trouble, but, as will be readily seen, cannot give as good results.

There are many other ways of trellising, but as they possess no advantages over the one given, I will not describe them.

A few words about marketing: Do not be in a hurry about gathering; a green grape is an abomination, and anyone buying a basket and attempting to eat them will be apt to forswear grapes for the rest of the season. Most of the black varieties require from 10 to 14 days after coloring before they are fit to eat. If for market they should be gathered only when perfectly dry. A pair of scissors is best for cutting the stems, and the hands should touch the grapes just as little as possible, for a basket of grapes showing finger marks is not attractive.

If the grapes are to be shipped any great distance the crates containing four five-pound boxes are the best package; but if for a near-by market the four and eight-pound baskets will probably give best satisfaction. These are very neat, and many persons will buy them just for the basket.

Large quantities of grapes were shipped from Portland to Puget sound, and a few even to San Francisco during the past season.

The expense of starting a vineyard is large, and should be well considered before planting. It might be well to give a few figures showing the principal items of expense. Land, say, $50 per acre; good, deep plowing, $2.50; harrowing, $1; digging holes, $15; stakes, $8; planting, $12; vines (800, at about 4 cents), $32; cultivating, the first season, eight times, $8; hoeing, two times, $3; tieing to stakes and pinching laterals, two or three times, $4. This makes a total for the first year of $135.50. The second year: Pruning in winter, $2.50; plowing, cultivating, hoeing, etc., for season, $20, bringing expense to $158.05. The third year the trellis will cost: Wire, $5; posts, $22; setting posts and stretching wire, $15; total, $52. Pruning, which is greatly increased, cultivating, etc., for the season, $25, making a total for the three years of $235. These figures are certainly as low as anyone could expect to do the same work for. It is generally considered that an acre of grapes in full bearing has cost very nearly $500; but as the crop should pay its own way after the third year, I do not count the expense beyond that time. Grapes should be in full bearing at eight or nine years, and with proper care continue for fifty or one hundred years, so that there is ample compensation for the heavy expense of getting started.

New varieties of grapes are originated by planting seeds; old ones are propagated by grafting, layering or by cuttings. Cuttings should be of well-ripened new wood, six to ten inches long, containing two or three buds, cut off smooth with a knife just below the lower buds and an inch or so above the upper one. They should be taken from the vine in November or December before hard freezing weather, but in this mild climate they will usually be just as good in February. If cut early, bury in a well-drained place, covering the tops with straw, then dirt over that. As soon as ground will

do to work in the spring prepare a rich bed and plant cuttings deeply, leaving the top bud barely out of the ground. They should be carefully hoed and watered if needed. With good care they will make sufficient growth to allow of planting in the vineyard the following spring.

The majority of Oregon soils will not need any manure for grapes for several years, as too rich a soil causes such a growth of vine that it is difficult to keep them within bounds, but if the soil is poor and not giving satisfactory results apply stable manure in the desired quantity in the fall and let lie on top of the ground until spring, then turn under with small plow and pulverize with cultivator.

The profits of grape-growing are not very large, and anyone not reasonably well equipped cannot meet the keen competition successfully. Prices in the east this year ranged from six to ten cents per nine-pound basket, though prices here were very much better. This shows what we may expect in the future. A fair, average yield per acre would be about four tons; if it falls below three tons there is something seriously wrong with the grower or his vineyard. With these figures of expense and yield anyone can obtain the maket price and figure his probable profits.

It is hard to find more delightful work than the care of a vineyard, and where there is a family of children it is an ideal occupation.

THE PRUNE.

By JAMES R. SHEPARD.

No other pursuit has ever been, to the idealist, so attractive as that of horticulture. To the overworked clerk or professional man, confined to artificial surroundings, a glimpse of an orchard laden with blossoms, or bending beneath its load of golden, purple or crimson fruit, is intoxicating. But however much we may or should regret it, ours is an intensely materialistic age, and the paramount question is "Will it pay?" This applies in an especial manner to the prune, for it is surpassed by the apple, the orange, the peach and the cherry, in indealistic qualities. Hence I leave it for others to discuss this phase of the orchardist's life, stopping but for a moment before entering upon a practical discussion of the question, to endorse the view of that eminent physician who claimed that the diet of inmates of our penal institutions should consist largely of prunes, because of their ethical virtues.

What I shall say in the following pages is from the standpoint of an orchardist who for sixteen years has been personally identified with the development of the prune industry in this state. To other sources, such as our experiment station bulletins, the reader must look for scientific discussions on this subject. There are many points new beginners are always interested in knowing, such as depth to set trees, how to lay off straight rows, preparation of soil, how to spray, etc., which have all been exhaustively treated from time to time by others. The literature on the subject is quite extensive and the prospective prune-grower will do well to procure and study it carefully. I shall not attempt to cover the entire range.

The five years ending in 1892 will doubtless never be duplicated in Oregon in the amount of interest taken in the planting of orchards, with the prune far in the lead, apples and pears following. As far back as 1865 Seth Lewelling had set out about five acres, consisting mostly of Italian prune trees, with little or no thought of their fitness for drying. He was followed in 1871 by Dr. J. R. Cardwell, who set out 1,000 Italian trees. In 1875 S. A. Clarke began setting out his orchard south of Salem. But not until 1886 or 1887 did the industry assume any prominence. Who among the old-timers can forget the interesting local and state horticultural society meetings of those days? The development of the business was marked each year by the gradual change in the subjects discussed: "What Varieties

Shall We Plant?" "Location," "Soil," "Exposure," "Distance Between Rows." A little later "At What Height Shall I Start My First Limbs?" "Cultivation," "Vegetables Between Rows," "Pruning." Later still came the questions relating to pests, and curing and marketing, which questions are still up for settlement.

Though there will never be again such a boom in prune-planting in Oregon, there will continue to be orchards set out, not large ones perhaps, but sufficiently so to furnish the comforts and means of living to many happy homes. For the sake of the inexperienced it becomes our duty to point out such mistakes as we have made and the settled convictions resulting from our experience. Discussing it pretty much in the order it came up for discussion in the process of its development from its inception up to the present time, I shall begin with the question—

WILL IT PAY?

Many orchards have been set out that have not paid. Prices ranged from eight to twelve cents per pound for dried fruit a dozen years ago, and absurd estimates were made of prospective profits. Many were led to go into it that never expected to give it their personal attention. They have found that prices have fallen below their ideas of profit. Farmers, too, who were already hard worked managing large wheat interests, set out orchards because they promised great returns. Their general farming interests have not been neglected, but their orchards have, because it paid best to do so, in their estimation. These classes agree that it will not pay to set out prune trees. I believe, however, that prunes will continue to be produced at a profit, but not at such a profit as to warrant any but those expecting to give the matter their personal and close attention going into the business.

Varieties.—The varieties grown in Oregon are chiefly the Italian, the Petite, and the Silver. Formerly some German prunes were planted, but are wholly discarded now. The Reiné Claude is one of the best for family use, both for canning or drying, but is not likely to prove profitable on a large scale. The Hungarian or Pond prune is only fit for shipping fresh. Because of its very superior size and color it is likely to always be popular for this purpose. The Willamette, no doubt identical with the Pacific, originated by Mr. C. E. Hoskins, of Springbrook, Yamhill county, is, I believe, the best prune to plant for profit, though it has not been extensively tested. It is larger than the Italian, and is much sweeter, yet has none of the insipidness of the Petite. It gives a larger per cent. of dried product than the Italian, and in the fresh state is very superior. One of its chief merits is that it ripens earlier than either the Petite or Italian, and is therefore much less liable to injury from early rains. The Silver prune has for the most part been a disappointment to those who have set them out, owing to a lack of vigor in the trees, and to the difficulty experienced in

curing them. It is necessary to bleach them in order to sell at fair prices. The Golden prune, originated by Seth Lewelling, was very superior as a prune, but an utter failure as a tree, every tree of 500 that came under my observation having perished. There are quite a number of other varieties, some of which may prove valuable in time.

Stock.—The great majority of orchards now bearing were propagated upon peach roots, because of the well-known tendency of the plum root to sucker. Of late, growers have been using the Myrobolan and Marianna plum, with variable results. The experience of two growers, Mr. C. G. Shaw, of Vancouver, Washington, and Prof. W. J. Crawford, of Zena, Oregon, will be of interest. In a letter just received from Mr. Shaw, he says:—

"I have on my place five acres of sixteen-year-old Italian grafted on plum stock, also fifteen acres on peach stock. I think the plum much more preferable, as the trees are hardier and stronger in every way. It has cost me $1.50 per acre per year to keep down the sprouts. I would not under any circumstances of soil or location use peach stock. I do not see that the plum is more free from pests. If I was going to plant another prune orchard I would get the pits of the strongest growing plums that I could find, plant them, and when they were, say two years old, would top-graft them as high as I wanted my trees to head out—about three and one half feet. Then I would have a tree trunk that would stand the freezes of winter and the scalding sun of summer. I cannot tell whether the Myrobolan is better than the Marianna or not, but know it is superior to the peach."

So much in favor of the Myrobolan. The experience of Professor Crawford with the Marianna is the reverse. He writes as follows:—

"Replying to your favor of the 6th inst., I will say that my experience with the Marianna plum roots for prunes has not been as satisfactory as I had desired. The young trees which were planted three years ago have not equalled the trees on peach root planted several years previous. They have manifested a tendency to die out; have lost more trees proportionately on these three-year-old trees than on an equal number of eight-year-old trees on peach root. The fruit has been considerably smaller on the plum root than on the peach root. The soil where the former is planted is about the same as that of the latter, with, perhaps, an excess of clay in it. I have an impression that the plum will stand better in wet soil than the peach, but my experience has not proven this to be so conclusively. As to the pests attacking the trees and the fruit, I have found no difference. I ought to say, perhaps, that the care and cultivation have been about equal, and that the difference observable cannot be attributed to this cause. I have been annoyed very much by suckers growing from the plum root at the base of the tree. It may be that the stock from which I obtained my trees was not the best, and that there was some fault in the grafting. On this

point I am not able to speak with authority. Again the same kind of stock might do better in some other locality."

From Mr. McGill, of the Oregon Wholesale Nursery Company, I learn that the Marianna stock does not grow as fast as the scion, and he much prefers the Myrobolan, thus corroborating the opinions of both Mr. Shaw and Professor Crawford.

In procuring trees from the nursery endeavor to set them out in the fall. In our climate this is not absolutely essential, but is best. If, however, you purchase trees in the spring, see that they have been dug before any severely cold weather affected the sap, which in the highly cultivated nursery tree is more susceptible to frost than in the orchard tree.

Eighteen feet is as near together as rows should stand. At this distance the roots and branches of nine-year-old orchards begin to interlace.

No prune orchard should be attempted on cold, wet, poorly drained soil. Select a rolling plain or upland, where the soil is warm or well-drained. If the land is low, be sure it is a sandy loam upon which no water can stand. Any soil in which water rises in a posthole to within two feet of the surface in the winter time is unfit for prunes. Northern exposures are preferable. Cultivate thoroughly, but not deep. Plow shallow early in the spring, and follow at intervals with the cultivator and clodmasher until the first to the fifteenth of July. Throw the ground to and from the trees alternately, in order to keep the ground level. Never conclude that your trees are old enough to stop cultivating them. Do not grow vegetables between the rows where their roots come in competition with those of the tree. For the first two or three years hoed crops may be raised.

During the first few years prune trees in Oregon make a very considerable growth. It is essential that this growth be cut back fearlessly each year, and that the limbs be thinned to produce a solid, stocky growth. This must be done in the late fall or winter.

Larger fruit.—Nature has given us an advantage over California in the size of our fruit, and it must be zealously guarded. Our market and reputation must be made on large fruit. Too much emphasis cannot be placed upon the superior value of quality in prunes as compared with quantity. *First*, because prunes running 50 to a pound are worth about three times as much as those running 100 to a pound. *Second*, because it is less expensive to gather, spread on trays, and dry a given quantity of large than small prunes. *Third*, because in years when there are large yields of small prunes, the large sizes command more than the customary premium of a half cent for each successive size. The Bordeaux correspondent of the California Fruit-Grower reports that at a large sale of prunes at Lauzun, France, on October 23, 50-55's sold at about 10½ to 12 cents per pound; 60-65's at about 6½ to 7½ cents; 70-75's at about 4½ to 5½ cents; 80-85's at about 3 to 3½ cents; 90-95's at about 2 to 2¾ cents; 100-105's at about 1½ to 1 9-10 cents.

A vigorous use of the pruning knife and saw will increase the size of the

fruit, but not sufficiently. Thinning should be resorted to. In the case of the Italian it is not expensive or difficult, owing to the size of the fruit and the shape of the tree. In seasons of large yields they should by all means be thinned by hand. The Petite is much more expensive and difficult to thin, the fruit being smaller, and the limbs are more difficult to reach. Yet it will pay well. An orchard of 500 trees that came under my observation last fall yielded 20,000 pounds of small dried prunes, worth $300, costing $150 to gather and cure. Had $50 been spent in thinning these trees there would have been, I estimate, 15,000 pounds, worth $450, and a saving of $50 in labor of gathering and drying—a net gain of $150, or just 100 per cent. This, it may be said, is only an "estimate." True, but I have no doubt of its practical accuracy. I have allowed 10 cents per tree for thinning, which is three times what it has cost me in actual work for Italian.

Pests.—In the moist climate of Western Oregon fungus diseases have in the last five years been increasing. The worst of these are brown rot, shot-hole fungus, prune rust, gummosis (if indeed gummosis is a fungus disease), and a disease I have never seen named, confined chiefly to the Italian, that attacks the pit and gradually extends through the flesh to the stem, darkening it, and producing an unpleasant odor. Insect pests have so far shown little disposition to injure the prune in Oregon, and we may well hope that they will find our climate uncongenial.

Spraying.—I confess that at present prices for prunes I am loth to discuss the subject of spraying. It is expensive work. One of the most experienced prune-growers in the state said to me recently: "It will not pay to spray our prune trees. When I have to do so, I'll quit raising prunes, or get more for them." When the test comes, however, I think he will be found using the bordeaux mixture for prune rust, shot-hole fungus and brown rot. It is conceded that the use of this mixture will greatly reduce most fungus diseases. For an exhaustive discussion of this subject the reader is referred to the Oregon experiment station's bulletin on spraying. Let us spray our trees, and keep up the quality of our fruit.

Gathering for the dryer.—Several attempts have been made to use harvesters, the best I have seen being that invented by Mr. A. B. Enns of Dallas. It consists of a hopper-shaped sheet on a wheelbarrow frame, that is run under the tree and catches the prunes as they are shaken off, a box beneath receiving them through an opening in the center. In practical use nothing seems to entirely take the place of hand-gathering from the ground. One should not begin gathering for a week or two after they begin to fall, by which time the ground is fairly covered. No shaking should be done until perhaps the third or fourth gathering. No point must be watched closer than that of avoiding green prunes in the dryer. If the stems are attached, they are too green. An excellent way is to contract with someone to deliver the prunes to the dryer. Four to five cents per bushel were paid in some instances the past season.

Evaporators.— The evolution of the prune evaporator in Oregon has been an interesting study to those who have watched it. Dr. J. R. Cardwell, of Portland, undoubtedly deserves the credit of having constructed the first prune evaporator in the world. When his first Italian trees came into bearing, he discovered their great value for drying, and after great expense in experimenting with various schemes, evolved practically what is now known as the box evaporator. This was the prevailing system until about ten years ago, since which time many sleepless nights have been spent by inventors who have sought to produce the ideal evaporator — one having large capacity for amount of room occupied, having a steady, rapid circulation of hot air, evenly distributed throughout all parts; safety as regards fire, and least possible consumption of wood, and to these has been added more recently, by some, one in which the heat is gradually increased from the time the fruit is put in until it is finished. The old-fashioned box served its time, but is not now being built to any extent. A system very similar to the box, consisting of inclined trays, permitting the heat to pass between instead of through the trays, is now struggling for supremacy, with another system wherein the trays gradually approach the highest heat by mechanical device. Each system is represented by several patents, and it is fair to say that neither has fully demonstrated its superiority to the other. Both approach the ideal much closer than the old system, and both produce very superior fruit. The argument in favor of the gradual approach system is best stated by Mr. W. K. Allen, of Newberg, the pioneer, I believe, in this idea, unless he must share the honor with Clinton I. Kurtz, of Salem. The argument, briefly stated, is that by fermentation starch and water combine in the prune in forming grape sugar, making the weight of the sugar greater than that of the starch alone, and that this fermentation, which is promoted by moderate heat, is checked at 140 degrees, and entirely destroyed at 160 degrees. By submitting prunes to a moderate heat at first, until the starch is entirely converted into sugar, and then gradually increasing the heat to 160 degrees, he claims it is unnecessary to make the fruit as dry as when cured in the sun, or in evaporators where the fruit is at once subjected to a degree of heat sufficient to destroy fermentation and stop the chemical change of water and starch into sugar. By this process it is claimed a sweeter and heavier prune is obtained.

The opponents of this system claim that though a tray of fresh prunes be subjected to an atmosphere of 160°, the rapid evaporation ensuing will keep the temperature of the prunes much below for six or eight hours, during which time the chemical change desired has time to take place; that much time and fuel is consumed in the low heat; and that the mechanism necessary is expensive and apt to get out of order. It is a matter that must be decided by scientific men in a scientific manner. I trust our experiment station will take it up and decide it in their own laboratory next prune-drying season. I would suggest that in the meantime analysis be made of

samples of prunes dried in a steady heat of 160°, and also prunes dried in a steadily increasing heat. Samples should be of equal weight, as a small prune has always less sugar than a large one. A final test, and one that would be entirely satisfactory, should be made of prunes of small size, same degree of ripeness, and from same tree, by the chemist himself in his laboratory. We have a surplus of moisture in Oregon, and if a part can be converted into real good grape sugar and shipped away, let us know it. Other systems of evaporation are being followed, but I have seen none that equal the two named above, in my judgment. Prunes should be graded before drying to avoid over-drying the small and under-drying the large ones, also to remove trash, stems and culls. The lye tank is much superior to the pricking machine, as it checks every portion of the prune, cleanses the fruit and makes the skin tender. Abundance of fresh water is absolutely essential to wash the lye off. Allow your prunes to stand in bins two or three feet deep for from one to three weeks, shoveling them over two or three times, as it improves their appearance and texture, evening up those that are too hard or too soft.

Shipping fresh.—The experience of growers in Oregon has not been such as to encourage them to market their prunes in this manner. Heavy losses have been sustained in the past, but with lower freight rates and a better understanding of the business, we may hope for profitable results to follow. It is very probable that those sections lying east of the Cascades will in time market a large portion of their Italian prunes in the fresh state.

Marketing our dried fruit.—There is at present absolutely no concert of action on the part of the growers in this matter. A few years ago consignments were made to eastern commission houses, but of late the majority of fruit is sold locally. The reluctance on the part of a grower who has condensed a year of hard work into a car of prunes to allow them out of his possession before he has his money, is natural. We prefer taking a lower price at hand to the risk of shipping our prunes to parties we have never seen. Yet I have always believed that consignments to reputable houses would net us the best returns. The commission house is throughout the season introducing our fruit to the trade everywhere, and securing for us the highest price possible. It requires several months to work off our fruit, it is true, and we would need cash advances. But the enhanced value accruing to us would more than pay the interest on such advance. As it now stands, we grow panicky at every depressing telegram received by the local buyer (he reads no other kind to us, and who can blame him?) and stampede in our anxiety to sell before the market breaks. About 90 per cent. of the prunes in Oregon were sold last fall before the last of November at prices considerably below their statistical value. By December 15 prices had advanced about one half a cent above the average price received, aggregating an unnecessary loss to the growers of not less than $25,000. Had these prunes been placed on sale throughout the east, there would have

been no such break in prices as was witnessed, for it was precipitated by the eagerness of growers to sell. How to engender the confidence necessary to make consignments become general, remains to be developed. Of one thing I feel certain: Should the system of selling locally become too firmly fixed to be overthrown, the grower will never receive his just proportion of the price paid by the consumer. It is a system that invites speculators. I have no fault to find with the gentlemen who engaged in the business the past season. So far as I know, they acted in perfect good faith throughout. It is the system that I am objecting to.

ITALIAN PRUNE ORCHARD, NEAR SALEM, SIX YEARS OLD.

THE PRUNE AS IT GROWS IN OREGON.

By Charles L. Dailey.

There are few industries in this country but what have gradually grown to their present proportions from small beginnings, many of them having been old established lines of trade in Europe long years before America took them up as a home production. Prominent among these occupations none have accomplished a firmer foothold or more rapid growth in the United States than the production of prunes, which from small beginnings at a comparatively recent date have grown to one of the large and staple industries of the present day. That this occupation has come to stay goes without saying. But should any doubts be entertained one will only need to examine the records of annual consumption, the national demand for the article, and the fact that practically none are now imported, very nearly the entire product being produced here.

A prune is nothing more or less than a dried plum, but all dried plums are not, strictly speaking, prunes. The plum which makes an acceptable prune of high grade must possess the quality or conditions which enable it to be cured without ferment and leaving it in a finished condition, sweet, sugary, mellow, palatable and with good keeping qualities. These conditions few plums possess, so that in general prunes are referred to as a distinct variety of fruit belonging to the plum family. The prune can be grown in a more or less successful way in nearly all parts of the United States, but in some sections it does not fruit well. In others insect pests which cannot be eradicated make it unprofitable, so that at the present time New Mexico, Arizona, California, Oregon, Washington and Idaho produce practically all the available article of commerce, California taking the lead in point of quantity and Oregon an easy second place. Much rivalry has existed between these various sections of country as to their merits in the production of the prune and other fruits, so that a stranger traveling from one to the other would find each claiming all that was good and allowing but little, if any, credit to the others, much the same as half a dozen merchants in the same town, all buying the same goods from the same wholesale dealer, each claiming his goods only were worthy either in price or quality.

It is probable that history will repeat itself in this case as in many

others, and that time will demonstrate that certain valleys and locations of country are best adapted to the prune, others to the apple, orange or peach, and that section so favored in an all-around manner, everything considered, will in time receive its undisputed and just reputation the same as it has in the older countries of Europe. It is not the object of this article to compare or discuss the relative merits of the various prune-growing sections of the west, but rather to refer to the prune as it grows in Oregon. Time and the inevitable laws of trade will settle the former, no matter what the individual or section may think.

Early in the history of Oregon it was discovered by the immigrants from eastern states that the climate here was wonderfully adapted to fruit growth. Wild berries seemed as natural and as much at home in the open fields as the grass which everywhere grew in luxurious profusion, and as the years passed by and brought with them the improvements of civilization, it was found that of all the fruits, none were more perfectly adapted to the climate and soil conditions than the plum, its yearly yield of delightfully luscious fruit being nearly as sure as the seasons. Gradually the successful culture of the prune and the large monetary returns received therefor brought this fruit prominently before an enterprising public, and today we find an acreage of prune orchards in Oregon equaled in extent only by our neighboring state of California.

The prune as grown in Oregon differs materially from the production of several other prune-producing sections in several prominent features. We do not irrigate our orchards, there being ample rainfall to stimulate and grow all vegetation in a natural, healthy way, and this without the eternal downpour that is sometimes supposed to occur. This insures a plump, meaty, sugary fruit, of largest size, at the lowest cost of labor. We grow varieties not generally found elsewhere, unless it be in Washington, and therefore new and unlike the old and familiar brands of commerce. We cure our fruit entirely by the evaporation process of passing hot air artificially heated through the fruit, thus insuring a clean and bright product unobtainable by any other means.

In growing an orchard of prune trees the present generation have many advantages over those of the past. Many theories have been found wrong, and much needless expense of the past can be avoided. The general principles governing the growth of orchards in Oregon are few, but must be observed with strict fidelity, the neglect of any one being fatal to highest success.

I care not what branch of the life principle you pursue, be it animal or vegetable in its countless forms, the one great unyielding necessity for perfect growth is a perfect start, a perfect life germ, and careful, painstaking nourishment through infancy. You cannot make an athlete out of a poor crippled child, nor a sturdy oak from musty acorns.

This is as true of a prune orchard as of an oak, and he who wishes to

succeed in the highest degree growing prunes cannot take too much pains to see that his start is right. Select trees of careful, responsible nurserymen, or grow them yourself, then transplant them with care, preserving the full root system as much as is possible to do. See that your soil is well prepared, mellow and dry, and you have started on a foundation that will stand, and on which you can rely. The first year's care of an orchard is of more importance than those that follow. As a tree grows the first season so it will grow after that, and I think it economy of time and labor to root out at the end of the first season all those trees which have not shown a hardy and thrifty growth, replacing them with new stock. Every prune orchard in Oregon should be annually pruned and cultivated, not in an excessive manner, but after the way of moderation. In this damp, moist climate, with late spring rains, a constant use of the plow and harrow is not needed, nor would I go to the other extreme and allow grass and weeds to grow. Moderate treatment is best. These few points receiving careful attention, the natural, climatic and soil conditions will do the rest, and any person obeying them can succeed with the prune in Oregon, at comparatively small expense.

The varieties of prunes grown here are generally referred to as three, Italian, Petite, and Silver, which for all practical purposes is correct, though we have several others which are grown in a small way, and possess much merit. The Italian variety is far in the lead as to acreage, and stands alone in the markets as the Oregon prune. So different is this prune from those of California that it would be a dull person indeed who would mistake one for the other.

The Italian is a large, black fruit, with an aromatic subacid flavor, while the French prune of California is a smaller, lighter-colored fruit, and very sweet to the taste. It is sometimes amusing to hear people talk of California filling her orders with our larger Italian prunes, or buying them of us to face their boxes. The two fruits could not go together, and could not be used in that way.

The French or Petite variety of prune grown by us is the same as the Santa Clara prune of California, but in our process of curing the fruit by evaporation it very much changes the general appearance of the finished product from that of California, which is dried in the sun, and it is not probable that any eastern buyer, well up in his business, would mistake one for the other, even in this variety. For these reasons Oregon prunes are classed by themselves in the markets, and must stand or fall on their merits.

The Silver prune, as grown here, has disappointed us in many ways. It is a beautiful fruit when well handled, but the extreme tenderness of the tree and extra care necessary to cure the fruit makes it an undesirable addition to our orchards.

The curing process employed by the prune-growers of Oregon is perhaps

as great an agent as any other in imparting to our prune their distinctive features. In as few words as possible, the process consists in circulating heated air through the fruit, and carrying off the moisture thus absorbed, until the water is all extracted and the prune left perfectly cured. This process is accomplished in so short a time that fermentation is avoided, and the whole tendency is to leave it clean, bright and meaty, somewhat more solid than sun-cured, but more fruity and rich in flavor, having much the same taste when cooked as the fresh article.

As to the details of building an evaporator and managing same, treatment of various insect pests and diseases which give trouble and annoyance in every country, there is now to be had much valuable literature on the subject in Oregon, and it is not necessary to treat of them here. What interests me today is the question: Can Oregon hold her place in the future as a prune-producing state and increase what has assumed worthy proportions? I am somewhat of a believer in the old doctrine of "a survival of the fittest," and I believe this whole prune question in the end resolves itself into a mathematical proposition, a matter of business. All else being equal, that state or section of country which can grow a prune of given quality with the least outlay of labor and expense, is going to be the last to give it up. If one man produces two bushels of fruit to the tree and the other one bushel, both doing the same amount of labor, the two-bushel fellow will outsell and outlast the other, and so I think about states.

We have soil — no one can for a moment honestly question it. We have rain. God does his part in this country that way. Our trees bear heavy crops and grow large. We need spend comparatively little labor on cultivation to keep up moisture. So far we have had but little expense spraying the prune. It grows any way. We can, I think, cure our prunes in evaporators about, if not quite as cheaply as in the sun, and do it better. Transportation facilities are in our favor; we have four great lines of railroad running east to markets from Portland. There are other reasons of minor importance that could be given, and perhaps some objections could be cited on the other side of the question, but taken all in all, I believe Oregon has at least a fair fighting show to be found at home twenty years hence in the industry of growing prunes for market.

ITALIAN PRUNE TREE SIX YEARS OLD.

THE PRUNE AND THE METHODS OF EVAPORATION.

By R. D. Allen.

There is perhaps no subject connected with fruit-growing about which more is said and written than that of the curing of prunes for market. Horticultural papers and reports are replete with utterances on this subject, and it would seem that nothing remains to be said. However, when we consider the importance this subject bears to the development of one of the greatest industries in this state, and that the art of curing prunes is yet in its infant stages and that much yet remains to be learned in regard to it, I believe it is proper and pertinent to continue the discussion to the end that out of its prolixity we may blow the chaff and gather the golden grains of information formed of experience, the foundation of all useful knowledge.

FIRST-CLASS FRUIT REQUISITE FOR BEST PRODUCT.

While there is some difference of opinion on the theories of prune drying, all experienced fruit-growers are agreed on one point, viz., that to make a first-class evaporated fruit of any kind, strictly first-class fruit, thoroughly ripe, is absolutely necessary to begin with. If the fruit is inferior when it goes into the evaporator, you may rest assured that its quality will not be enhanced by the process of evaporation. It is also a well-known fact among experienced orchardists that you cannot grow choice fruit (and it does not pay to grow any other kind) without cultivation of the trees, intelligent pruning and, on light soils, the use of proper fertilizers. In actual tests made by me the past season I find that the small sizes of a given variety of prunes shrink more in drying than the larger sizes. For instance, in one careful test with some trays of Italians I obtained the following results :—

One tray, 70-80's, yielded 22 per cent.; one tray, 60-70's, yielded 25 per cent.; one tray, 50-60's, yielded 28 per cent.; one tray, 40-50's, yielded 35 per cent.; one tray, 25-35's, yielded 40 per cent. The market price of 40-50's on the usual basis, is just 2 cents per pound more than for the 70-80's. It costs more to handle the small fruit than the large — takes up more room in the dryer, and takes fully as long to dry, owing to its greater proportion of water, and last, but by no means least, it is inferior in quality, and is one of the factors in creating a dislike for prunes among customers, who have

not yet learned what a first-class 40-50 Italian prune is. In view of these actual facts, what is plainer than that the prune-grower should study and work for the larger sizes? And who will say that we cannot grow the larger sizes if we work to that end?

STANDARD DRIED PRUNES.

What is the standard of excellence in a dried or evaporated prune? This is a question about which there is a seeming indifference, both among growers and dealers, yet is of the most vital importance to the development of the prune industry. Any lover of the prune, or grower who takes a pride in his work, and whose sole aim is to excel in the quality of his product, can quickly and correctly tell you what constitutes a strictly first-class cured prune. He will describe it as follows: Forty to fifty to the pound; not hard nor bony, neither soft nor mushy, but leathery and pliable; if of the Italian variety, the outer surface very dark, and when held up to the light has a rich, pinkish, translucent appearance very beautiful to behold; the interior neither black nor even dark, but has that rich golden cast natural to the fruit when in the raw state and thoroughly ripe. When properly cooked such prunes retain their bright, fresh appearance on the interior, and the juice is clear, aromatic and rich, delightful to the taste, and no lover of fruit who has been fortunate enough to sample such a delicacy was ever heard to utter that odious expression, "full of prunes."

It is improperly cured prunes, black or dark inside, with an uninviting appearance when cooked, the juice of which is dark and muddy looking with an unsavory smell that calls out such expressions which are intended to convey feelings of disgust for prunes generally, and no wonder.

To us as growers, then, desirous of putting upon the eastern market a product that will please the palate of the purchaser, causing him to "come again," and become addicted to the use of the *Oregon prune* as against "all comers," thus enabling us to stand at least an equal show with our formidable competitor, California, is it not of the greatest importance that we should ourselves first learn what a good prune is, and then teach the consumer by offering him no other? While there are a great many growers in the Willamette valley, and I presume in other sections of the state, who realize this, and aim to, and perhaps do come up to this standard in the curing of their crops, it is a noteworthy fact that many do not, and are quite indifferent as to the quality of their goods, so long as they will sell just as well as any; and the force of this remark was quite apparent to me this last season, when the buyers who took the Silverton output of 116,000 pounds last November only examined to see if the fruit was dry enough to keep. Whether it was scorched or overdried, or black inside, or stuck up with the drippings of jelly, was of no concern to the buyer. When asked why he did not examine the fruit more particularly—especially why he did not look on the inside, I was somewhat disappointed to get this answer: "Why, my dear sir, I have been in the dried prune business for the past

twelve years, and nobody ever yet saw me break open a prune to examine the interior. I don't care how it looks inside. If the outside looks are all right, that is quite enough. The fruit always sells to the consumer on its looks—not on its merits." When asked if he did not test the Italian by holding it up to the light, he replied: "Indeed not; the Italian must look black, and if a little glossy, all the better. Don't care anything about the inside." Now, I will confess that I was somewhat disappointed, for after all my pains was I to get no credit for keeping about 600 pounds of badly scorched prunes that had accumulated in the drying of about 38,000 pounds entirely separate from the main lot, and also about 6,000 pounds of Italians that were so ripe that in the drying, in spite of all I could do, about all the jelly in them exuded and stuck on the outside, making as poor a product as could be imagined, also separate? These damaged prunes were put in bags like the others, but carefully marked, and I took special pains to call the attention of my buyer to them, explaining their condition and the cause. He barely glanced at them, saying, "Oh, they are all right; they will go," and they went right along with the rest of my lot, which were, indeed, all right.

Now, I am informed that dealers generally do not submit prunes to the test above indicated, only requiring that they be dried, and I ask, in all seriousness, is this the way to create a heavy demand for our prunes? Why should some of us go to the expense of fitting up waterworks for the thorough cleansing of our fruit, take special pains in drying it properly, when others, who take no such pains whatever, sell theirs just the same, and get just as much for it? Well, I presume this is one of those questions that will be answered in time. I believe the time is not far distant when buyers will discriminate, and for that reason we should continue to endeavor to come up to the standard of excellence. At any rate, we will then have the proud consciousness of doing our part faithfully, which is worth something.

The sulphuing of prunes demanded by the trade, but condemned by common sense, and should be abolished.—In the discussion of cured fruits, the practice of sulphuring certain varieties invites our attention, and a few remarks in relation thereto may not be out of place here. On asking the buyer alluded to in the foregoing if he would take some evaporated Silvers and some Bartlett pears, I was met with the query, "Are they bleached?" Answering in the negative, he promptly said "No, I don't want them. Can't sell them." On assuring him that the stock I offered him was first class, and much better in quality than if they had been bleached with sulphur, he curtly replied, "Hang the quality, we don't care about that. We want an article that will sell. A bleached prune or pear captures the eye. The taste cuts no ice. Looks is what sells fruit every time. Therefore, if you are curing Silver prunes or Bartlett pears for market, sulphur them;

sock it to 'em till they have the proper waxy look and taste like a raw pumpkin smoked in the fumes of hades."

While this man, no doubt, in a measure, stated a disagreeable truth, at any rate, certain it is that the fruit trade generally demands bleached dried apples, pears and Silver prunes. It is a fact greatly to be deplored, and it seems to me that there is no question for the solution of the fruit-grower of more vital importance to the fruit industry, and to the health and welfare of fruit consumers generally, than that of teaching the latter to discriminate between fruits that are natural, wholesome and of fine quality, and that which is unnatural, spurious, of low quality and deleterious to health. There should be a vigorous and organized campaign of education along this line, and the state horticultural society could not engage in better work than to take steps looking to the bringing about of such desirable results.

The proper time to begin drying prunes and the length of the season in which they may be properly cured.—It is frequently stated by those who have spoken on this subject that the drying of prunes should not begin until the fruit begins to drop from the tree of its own accord, and that the orchard should be gone over several times during the season, the trees slightly jarred or shaken, when the ripe fruit only would fall—that there is little danger of the fruit getting too ripe, but much danger that it will be plucked too green, etc. Now this is prehaps the correct way with the Petite d'Agen, but does not apply to the Italian, and it is with this latter variety that we have to deal chiefly, as about 80 per cent. of the prunes in Oregon are Italian. With the Petite the drying season may be prolonged without serious loss.

In 1897 I had some Petites which I neglected until I had worked on Italians as long as they were in fit condition. The Petites were then attended to, and I found them in a perfect state of preservation, although they had been lying on the wet ground for about three weeks. They had shriveled up considerably and yielded 27 pounds to the bushel box of as fine fruit as one would wish to see. But with Italians we have found it altogether different. We find that while we can work on this variety from twenty to thirty days, there are only about fifteen days in which they are in prime condition for curing. We find that the horticultural writer who instructs us to shake the tree gently so that the ripe fruit only will fall, was just talking through his hat. We find that when we shake the tree green fruit is just as apt to drop as ripe fruit, that the ripest fruit will often cling to the stem longer than any and will actually stay on till it becomes too ripe to make a good product. We have learned that in the same orchard will be found trees of varying degrees of ripening. While the fruit of some will be ripe enough to go in the evaporator the next tree will hardly do, and still another is quite green. We find the proper way is to wait until the first in ripening are at the proper stage, then begin by giving the tree a vigorous shake and remove at least half of the crop the first picking, and

I am not sure but it is just as well to make a clean thing of it the first time. The ripe trees are easily detected, and by carefully selecting them in the order of their ripening — which anyone accustomed to the work can easily do — much useless and unnecessary tramping and skipping about from tree to tree is obviated. While this variety of fruit must necessarily be thoroughly ripe, it must be gathered and got into the evaporator before it gets too ripe — a condition indicated by a wrinkling at the stem end, and the oozing out of the juice on being removed from the tree. When the Italian prune has arrived at this stage there is a darkening at the pit, and a bright color such as is desired and explained at the outset of this paper cannot be obtained, besides for some unknown reason, possibly on account of the toughness of the skin at this stage, and the closing up of the pores of the same, the fruit is hard to dry; and I found this year for the first time that the fruit arrives at a stage, in time, that renders its successful evaporation practically impossible, yet the fruit had the appearance of being good when put in the dryer. For the reasons stated it is of the utmost importance that the drying capacity be sufficiently large to handle the entire Italian crop inside of fifteen days.

EVAPORATORS CONSIDERED.

While much has been learned in the last few years in regard to the construction of evaporators, we have not yet arrived at perfection. However, each returning prune harvest brings us a little nearer to that goal we are all seeking, and no doubt a few more seasons will bring us to the coveted prize, when we'll wonder why we did not study the thing out long ago.

There are now two different systems in the construction of evaporators which are occupying our attention, towit: *First*, what is known as the stack system, by which the fruit first comes in contact with a low temperature, which gradually increases to the maximum as the fruit, by automatic action, is made to approach the higher heat, where it is finished. The adherents of this system claim that a better product can be made by this method, and that there is less shrinkage. The Allen drier, the Fleckenstein, the Cunningham and some other styles are made on this principle. This system presupposes a large inflow of fresh air, with ample means for its rapid exit up through the fruit. *Second*, the ventilated-tray system, by which a regular temperature is maintained from start to finish, with trays so arranged that the flow of heated air passes between the trays, making its exit from the side, without coming in contact with the fruit above. The Carson and the Stephens are fair examples of this class of dryers. F. M. Starrett, of Silverton, and Ritchie and White, of Scotts Mills, have designed and operated the past seasons very successfully most excellent dryers constructed on this principle, using, however, steam in coils of pipe for generating heat, instead of furnaces.

Now while the science of chemistry has been brought to bear by Mr. W.

K. Allen and others, whose knowledge of fruit evaporation is acknowledged by all, and whose success in putting up high-grade fruit is conceded, to show that only first-class prunes can be made by the stack system, or at least that a better evaporated article can be produced by that method than by the ventilated tray method, and while I have no doubt that these gentlemen are sincere in their views, I have seen enough this year to convince any candid or fair-minded man that there is nothing whatever in the claim. I turned out some fruit by the Carson or Stephens method that I would gladly pit against any of the same variety ever produced in this or any other state. I do not claim that it was any better than hundreds of others turned out by the same method, but I will assert that it was just as good as any turned out by any method. It came up to the standard heretofore set forth in this article, so what more need be asked? I will add that I have a few stacks operated on the Cunningham plan, where the green fruit is put in at the top at a temperature of 110 degrees, and is taken out at the bottom where it is finished at 170 to 180 degrees. The plan worked very satisfactorily, but I was unable to see wherein the fruit was any better than that cured in the other part of my evaporator constructed on the second plan heretofore described. It therefore seems to me the question to decide is, by which method can the fruit be cured more economically, and for a given capacity which costs more in construction?

Now, if Mr. W. K. Allen, of Newberg, or Dr. Sharples, of Eugene, who, I believe, advocate the stack system from a scientific standpoint, will prove by an actual test—not by a learned array of chemical science incomprehensible to the average fruit-grower,—that by this process more of the soluble starch existing in the fruit is converted into fruit sugar by the former method than by the latter, a priceless boon would thus be conferred upon us and we would know just which method to adopt. The claim is, of course, that more pounds of cured product, and of better quality, can be made by this method from a given number of pounds of green fruit than can be made by the other method. Now I would suggest that the experiment station at Corvallis is the proper place to conduct such a test, and why could it not be done? The test should cover not less than 30,000 pounds of green fruit for each system, and should have the supervision of some one thoroughly conversant with the details of the art of prune-drying.

ABOUT LYE DIPPING.

I think it hardly worth while discussing this topic, any further than to say that I am convinced by actual experience, covering five prune harvests, that the best results cannot be obtained without properly dipping in lye, or some other preparation having a similar effect. Of course there is objection to lye-dipping where one is not prepared with an abundance of clear running water for thoroughly cleansing the fruit, but without such provision you cannot expect to have clean fruit anyway. It is a noteworthy fact,

however, that a great many curers of prunes are as indifferent in regard to cleanliness as they are in regard to the general quality of their fruit. They are fully aware that evaporation is greatly quickened by giving the prunes a lye bath, which checks the skin, and they dip for that reason, but not being provided with convenient water facilities, about all the lye the fruit comes in contact with in the boiler adheres to the skin and goes into the evaporator and into market in that condition, and hence the prejudice against lye-dipped prunes. But where water in abundance is provided, the fruit is thoroughly cleansed, and the presence of lye is entirely removed, except perhaps from the imagination of some inexperienced persons who will learn better by and by, and there is no necessity of advertising the fact to eastern consumers that such and such a brand of Oregon prunes were "cured without the use of lye or other injurious drugs," as was observed conspicuously labeled on a carload lot of boxed Italians shipped from Marion county the past season.

It has been asserted by some that by the process of lye-dipping, the fruit became impregnated with the salts thereof from surface to pit and was therefore injurious to the health of those who ate it. This, however, is not true with properly dipped fruit. In my experience I find it only necessary to immerse the fruit in boiling lye (I use about one pound of Red Seal lye to thirty gallons of water), allowing it to remain not exceeding five seconds, generally about three seconds, in which brief bath the lye has little chance to penetrate beneath the skin, which is thus amply checked, and by the thorough rinsing in pure fresh water, which is allowed to flow constantly through the tank used for the purpose, there is practically no lye left and I doubt very much if a rigid chemical analysis would reveal its presence in sufficient quantities to injure the fruit in any manner whatsoever. But we will admit that those who are only provided with well water, especially those who use old windlasses, and many times nothing but bare ropes for drawing the water, and out of 40-foot wells at that, are quite likely to injure their product by the use of lye. I have seen prunes dipped into lye and then dipped into what was supposed to be the rinsing tank, the latter being even dirtier and the water thicker with mud and other accumulations than the boiler containing the lye, and I even saw the past season one party dipping in lye without making any pretentions to rinsing them, saying that he had not water handy and that he would sell his product just as well as those who were so pesky particular about such unimportant (?) details. Well, I have no doubt that he did, but I have my doubts about the advisability of continuing such practices, which must in time receive the strongest condemnation, and the sooner such practices are abandoned the sooner will we be able to establish the reputation among consumers that we so much need—that of producing the best prune on earth. This we can do, but not by methods of slovenliness.

VENTILATION.

In any system of evaporation an abundance of air circulation is absolutely necessary, yet there are some prune evaporators in the Willamette valley in which provision for this is absolutely lacking, and in such evaporators it is utterly impossible to turn out first-class fruit. Such dryers are mere bakeovens, and the product shows it by its blackness inside and the exudations of the fruit juices on the outside. No one engaged in the curing of hops ever thinks of curing a kiln without admitting a large inflow of air near the floor of the heating chamber and allowing it to escape through large, open ventilators overhead, thus forcing a strong draught of air, which becomes heated in the heating chamber, up through the hops which are spread out on the drying floor, thus rapidly taking up and carrying off the water contained in them.

Now, the extraction of the water from the prune is the object aimed at in our evaporators, and what is best in hop-drying applies equally to the curing of prunes, yet I have seen a great many so-called prune evaporators in which this fact was entirely ignored. For instance, one man whom I have in mind, has a large hop-drying plant and also a prune evaporator of about 100 bushels capacity. In his hop-dryer he has openings near the floors of his drying chambers for the inflow of air, made of long doors about two and one half feet wide, hung on hinges, the said doors extending entirely around the large, square hot-air chambers. These doors are never closed entirely during the drying of a kiln, but are left open wide enough to make a space of about 18 inches, sometimes opening it its full width. He has large ventilators at the top left wide open, allowing a rapid exit of the air after its passage through the hops. He turns out first-class hops.

Why he does not carry out the same principles in his prune evaporators, I cannot understand. The heating chamber in this plant is, I think, 22x10 feet. He has the same heating capacity that he has in his hop-dryer. In the latter, supposing the heating chamber to be 20 feet square (and I think that is the size), and supposing the doors to be closed to allow 18 inches space (and it is never less), he has an opening for inflow of 17,280 square inches. In his prune-dryer (erected last summer), he has eight openings on each side, near the bottom of his heating chamber, made by leaving out a brick in the construction of the wall, which is equivalent to about 27 square inches, or a total inflow of 432 square inches, when all are left open. But more than one half of them were closed up, allowing a total inflow of less than 200 square inches. In my own evaporator of a tray space of 2,900 square feet, I have an inflow of 1,608 square inches, with exit space in ventilators of 1,800 square inches, and I find that none too much. In those evaporators where the stack system is used, it is absolutely necessary to have a very strong draft of hot air passing up through the fruit, which can be best secured by having very tall ventilating shafts. But where the venti-

lated-tray system is used, I find nothing gained by increasing the draft by this means. In fact, in my own experience I find that this can be overdone. I find that it takes longer by this latter method to evaporate prunes with a very strong draft of heated air, than by a moderate circulation. By the strong draft, the surface of the prunes becomes dry and the pores closed up before the interior water has all escaped, thus rendering evaporation slower than it would be by a moderate circulation. By the stack system, however, this condition is obviated by the steam of the lower trays passing up through the upper fruit, thus keeping the surface moist, and allowing the interior moisture to pass off. And hence in this system the stronger the draft the better, and to secure it, the ventilating shafts should be extended not less than 40 feet from the furnaces. In the ventilated-tray system, I would not extend the shaft much above the upper tray.

PRUNES AND OLIVES.

By S. T. Malehorn.

Twenty years ago I came to Oregon to regain, if possible, what I had lost from 1861 to 1865, in defense of my country's flag, namely, health. My experience in fruit-growing from boyhood, in Maryland, and later in Illinois, led me in the same line of thought and work here. I soon discovered that conditions were changed here, and I applied myself to the pleasant work of learning the new requirements and methods of this unknown region to me. The plum was not profitable to us on the Atlantic coast on account of the depredations of the curculio, so that but little attention was given to that class of fruit, while the peach was a success and very profitable. They grew to great size and age. After many years of fruitfulness they began to fail in vigor and productiveness, or a hard winter killed the whole top, back to the very trunk. The rule was to "buck" or saw off the large limbs to near the crown, in the spring, after which numerous limbs would shoot out all over the head with great vigor; these were carefully thinned out in June, and a new head was soon formed, on which a fine crop was gathered the following year, and many years afterward, of larger and better flavor than before. Doubtless, the same practices are still followed there to this day, thereby disproving the traditional or theoretical idea "that a fruit tree is injured and the roots die back as the limbs are cut off." With this preface to the subject upon which I now enter, I wish to say that I soon discovered that the life of the peach and its resistant powers against fungus and insect diseases were much less here than east of the "Rockies." The growing of prunes at the time I entered the state was in its infancy. Our southern neighbors made fun of our "foolhardiness," in imagining that we could grow prunes up here in "Webfoot." At the same time an agricultural paper in our metropolis threw cold water on the enterprise by constantly asserting that "Oregon could not compete successfully with California in growing the prune; that it was labor lost; that those having suitable sand subsoil, upon which the peach root would thrive, *might* grow them, but Oregon had better stick to growing wheat and cattle, for which it was most suited," and much other free advice, all of which was not heeded by everybody. About that time the Oregon nurseryman began to sell to the home trade and in an incredibly

short time Oregon prune orchards began to yield enormous crops of large, fine fruit, to the surprise of the old "croakers" and false prophets. About that time wheat-growers in the Umpqua valley, groaning under heavy mortgages and low prices of grain, made a brave and manly break from old ways and planted prunes, since which time mortgages have been canceled, and, until the present unproductive year, have been prosperous and happy. But this temporary setback will not cause them to turn into other channels; they are too well fixed to desire a change, and the future will secure to them the well-deserved name they have earned, together with the profits o their large plants. But there is still an unsolved problem of much concern to every prune-grower in the northwest — one that must be worked out by their own effort and observation, and that is, the kind of stock best suited to their own conditions of climate and soil; the root upon which to propagate their trees to insure long life and loss from natural causes, such as borers, woolly aphis, heat, cold, excessive moisture, lack of moisture and the various different soils which we find on almost every forty acres of our ranches. My experience, perhaps, is a little different from those east of the Coast range. I am only four miles inland; the rainfall is heavier, averaging nearly 100 inches, but we have no sleet at all, and snow very seldom, and 26 degrees is the lowest point the mercury has reached in eleven years of my observation. Otherwise this region is of typical Oregon type, the one so aptly called "the happy medium," between the two extremes north and south of us. I have found out already in eleven years that prunes of the different varieties budded on peach roots are short lived with me, not only on a clay hillside but also on alluvial and sand subsoil as well. I have also learned by sad experience that prunes on the almond are a total loss in six years, on any kind of soil with me. I learn, further, that prunes budded on myrobolan roots from the seed soon become a nuisance, not only in the nursery, but doubly so in the orchard, and that the pernicious habit of some unscrupulous nurserymen in planting all kinds of plum and prune seeds upon which they propagate prunes is still worse for the prune-grower, especially if any of those pits are from the Green Gage and Washington plum.

The above facts led me, six years ago, to purchase a few trees of the Clyman plum and Tragedy prune, budded on the Marianna plum. The first two years' trial was so satisfactory as to cause me to procure three thousand Marianna cuttings for the purpose of a thorough trial on my grounds. The spot selected was an island of ten acres, sand loam, but there are spots of heavy clay, and a gravel deposit running entirely across the plot, the gravel reaching the surface, and of such coarse and poor quality as to be unfit for vegetables for profit. The entire length of a thousand feet was used for planting. In April the cuttings had calloused, and roots formed one eighth to one half inch long. They were planted in rows four feet wide and eight inches wide in the row. Good cultivation caused ninety-five per cent. of

them to grow; in September two thirds of them were large enough to bud, and ninety-five per cent. of them took. The following June I pinched them down to thirty inches, and in ten days they formed beautiful, symmetrical heads; by fall they looked like strong two and three-vear-olds. These trees have been scattered over this country for a radius of ten miles, and have all lived, and many of them have fruit on this bad year. The smaller stock was budded to Silver, Golden, Reine Claude, and those standing in nursery row have all got fruit on, more or less. One Golden tree has a cluster of fine, large specimen fruit hanging on a slender limb. I grafted some Abundance plums on a few two-year-old roots in April, 1895; they made a wonderful growth, and kept right on all last winter, and were like snowballs with bloom. They had some very fine specimens of fruit on. Now, at one year from graft they stand ten feet tall, and are large enough in body to be taken for a four-year-old. Last year I paid my California budding expert $8 per thousand; he guaranteed ninety-five per cent.; the stock was in fine condition, and he earned $6 some days. This month I had eight thousand more to insert, but the stock was so smooth and easy to work, he took the job at $5 per thousand, and earned $4 per day, but I am to untie them in one month at my own expense; he again warranted ninety-five per cent. of a stand. Some of the Gross and Clymans, budded one year ago, stand eight and nine feet in nursery row. They are branched, and show great vigor. I have been digging out and filling in new stock for three years now; of course, thousands of roots have been severed and the ends left in the ground, and up to the present time I have not found a dozen sprouts in the nursery, and not one in the orchard. Of any other variety of plum root that I have used a wilderness of sprouts would have been the result. I find in propagating that they sprout around the collar for a year or two, about as much as apple stock does when grafted in collar. I am well aware I am treading on disputed ground when I recommend the Marianna cutting to prune-growers in the northwest. Nurserymen will tell you that a cutting is an unnatural way of growing trees; that they will not make a "healthy root," etc. They should also tell you that they use the LeConte and Garber pear cuttings for standard trees, and the prune cuttings for dwarf trees, and that olives are grown only from cuttings for stock. Judge Miller, of Texas, who first brought the Marianna stock into notice, says it is largely used in his state as a hedge. It is both useful and ornamental when loaded with its wealth of beautiful red plums, which are said to be of better quality than the wild goose plum. I have planted a half mile of hedge with it, and expect to keep on. By planting eighteen inches apart, and laping the limbs together till they unite, a regular woven fence can be made that will turn a hog; then by stretching a barbed wire or two above, as they grow up into it, no breachy stock will trouble your premises. If you don't want to dwarf your fence, you can let them grow at will, after

locking the branches, and the rapid growth they make will soon make a valuable windbreak, equal to any deciduous tree.

OLIVES.

Here, again, I know that many well-meaning persons will take issue with me upon what they will be pleased to call "foolhardiness," in offering any advice upon the culture of the olive in Oregon, but, my friends, I don't propose to hide away under a bushel what light I have on this important subject from the fruit-grower of Oregon. You need not look back more than a dozen years, when the south half of California ridiculed the north half, when a few venturesome men in the hills of Sonoma and Butte counties planted orange trees, claiming that they would never ripen so far north. Look at the result: Oroville sends her oranges into market in November, ninety days earlier than Riverside. Santa Rosa holds her annual citrus fair, and they have no trouble at all in carrying off the prize at the San Francisco exposition. Again history repeats itself, and we are told by the prophets of the arid regions "that the olive may grow north of the Klamath, but it will never yield fruit." My friends, the time is near at hand when the intelligent fruit-grower will determine locality by the use of the rain gauge and measuring stick. The maximum and minimum registering thermometers, now in use by the United States weather bureau, will, by careful use for a series of seasons, enable him to arrive at just conclusions of climatic conditions. The present system of state observations already give reliable data, when faithfully kept and reported; but, when two months following each other are blank, as was the case of last February and March, in the orange districts of a neighboring state, who can arrive at an average to make comparisons? Still, we have reliable data from Texas that a good fruit yield followed after the mercury fell to nine degrees. Is it not reasonable to suppose if in that extreme south latitude the olive will stand such a low temperature that the tree will be more hardy and stand still lower degree? But there is no need of using such a low degree here; there are thousands of localities in Curry, Coos and Douglas counties, where the minimum never falls below twenty degrees. At my place twenty-six degrees has been the lowest registered in eleven years. To my own knowledge there are olive trees in this county, at an elevation of six hundred feet, growing and doing well for five years. I am two hundred and fifty feet above sea level; have trees growing four years, and they seem to be as hardy as a mountain laurel. They grow slow the first two years, but after getting well rooted they make rapid growth. Last winter I purchased three hundred two-year-old trees from John S. Calkins, of Pomona olive nurseries, California. (I purchased of him because he is doing more to advance the industry than any other man on the coast, and his scientific work in crossing and producing new and valuable sorts, and giving valuable information to the grower free, should be encouraged.) The stock

came in good condition, accompanied by state inspector's certificate. The continued bad weather delayed work so long in the spring that it was the last of May before the trees could be set. The plot selected was heavy clay hillside, well drained naturally. It consists of every color, from white to black; it is very spotted, and would be considered a poor piece of land here. Part of the plot was set with strong, growing stock apples, three years old, and the whole planted to corn, in check row, and cultivated. At this time (September 1) the olives have made the best growth; even where the blue clay was very hard and dry they seemed to do best. There was no water or mulch used, and but one hoeing. I wanted to give them a severe test, and the result is more satisfactory, much better than on the sand loam in the nursery row, where they had extra work given them. Those planted four years ago are also making more rapid growth this season on the clay hillside than on the sand loam, and have made about a two-foot growth this season. I have no doubt whatever that they will yield fruit in due time, and do as well as my figs, which have been a grand success until this bad fruit year — they are barren this season.

Oregonians are noted for their conservative and slow business methods, and while they may be slow they are also sure; but there is a possibility of being too slow in experimenting with new, untried things in localities where the conditions of temperature and precipitation are right.

THE CHERRY.

(*Prunus Cerasus.*)

By Prof. George Coote.

The cultivated cherry is by some considered a distinct species, while others suppose it to be a domesticated variety of the wild cherry or gean. The tree is a native of most temperate countries of the northern hemisphere. It is generally understood that the first cultivated variety was introduced into England about the year 1515. The wild cherry, of which there are a great many varieties, is a much more hardy tree than any of the more improved varieties. Empires may rise and fall, liberty and slavery succeed alternately, ignorance and knowledge give place to each other, but the cherry tree will still remain in the orchards of Oregon.

Varieties of the cherry are continued by grafting or budding on stocks of the black or wild red cherries. These are of a longer duration than any of the orchard kinds. Some graft on the Morello for the purpose of dwarfing the tree and rendering it much more prolific, but the most effectual dwarfing stock is the Mahaleb, which, however, does not succeed well in all soils in Oregon as well as in other countries. For procuring new varieties, recourse must be had to raising from the seed. From these a good many new varieties may be expected. In order to be successful in raising new varieties, artificial means of pollination should be resorted to. In order to accomplish this, the petals and stamen should be removed, leaving the pistil intact only. This should be done with a small pair of shears, just at the time the bloom is about to open. Then cover with a paper sack, tying the mouth of the sach firmly around the branch below the bloom, so that no insect life may intrude. In this way all stray pollen will be excluded from the pistil. In about two or three days the pistil will be receptive. This may be determined by examining it, and when the stigma shows a glutinous substance over the surface, the desired pollen may be applied to the stigma with a camels' hair pencil. This done, the sack may be replaced again and permitted to remain until the fruit has begun to make growth, being careful to correctly label so that no mistake can be made. When the fruit has matured, the seed may be washed from the pulp and the seeds sown in pots or boxes, or other convenient places where they can be protected.

Soil and situation.—The most suitable soil for the cherry is a moderately rich, open, rather sandy loam, and a well-drained subsoil. Stiff, wet soils are not suitable, and so, on the other hand, are dry gravelly subsoils. The

trees require a large amount of moisture, especially the large-leaved varieties, such as the Hearts and Bigarreaus. In free soils the roots can more easily travel after moisture, but in clayey, or stiff loamy soils, when this is exhausted, they are fixed, as it were, in a compact, hard-baked mass, from which they can draw no moisture. In dry, loose soil, on the contrary, there is considerable circulation of air, which, being charged with moisture at night, will afford a supply of that necessary element to the feeding roots, not in abundance, it is true, but to a beneficial extent.

Pruning.—The cherry, as a standard, requires but little pruning after the stem has been reared and the six principal branches of the head originated. The stem should be grown so as to insure its tapering, and on this account it should not be stripped of shoots and foliage. The temporary side shoots left should not, however, be permitted to attain too great a length. They ought not be permitted to compete with the leader, but must be checked when likely to do so. These should not be over two years old, when they are cut close to the stem, in order that the wound may heal over more readily and with less risk of gumming. As the leaves on the shoots of a young tree are generally large, a few shoots will deposit a considerable quantity of albumen on the stem below them, and consequently in proportion to that amount the stem will be thickened more beneath such shoots than above them. Hence, the requisite taper form will soon be obtained and side shoots dispensed with when one, or at most, two years old. The head should be formed as directed for the pear, with this exception, that the first three shoots of the Heart variety may be shortened to fifteen inches instead of a foot. Two shoots from each should be encouraged, one situated at the end, the other four or five inches nearer the stem, so that there may be room for the branches to grow in thickness without pressing each other, thus preventing gumming. After the principal branches of the head have been started very little pruning will be required.

DESCRIPTIVE NOTES ON CHERRIES.

Centennial.—Fruit yellow, mottled with crimson; very sweet; an excellent shipper; tree rather tender in northern part of our state; better suited for Southern Oregon.

Coe's Transparent.— Fruit pale amber, with red, intermixed with pale blotch; tree hardy.

Downer.—A medium late variety; medium in size; heart shaped; smooth red, with lighter shadings; form of growth, erect; fruit excellent flavor.

Elton.—One of the very best of the Bigarreau; fruit large, quite pointed; heart shaped; pale yellow when growing in the shade; in full sun, blotched and shaded red; season rather later than medium; highly flavored; a good shipper, one of the best.

Governor Wood.— Fruit large; yellow, shaded with red, intermixed with many light dots; rich and sweet; excellent variety; adapted to all locations.

Rockport Bigarreau.— Fruit quite large; of a clear red and amber, with few spots intermixed; being quite firm, a good shipper, and ranks very close to Elton.

Napoleon Bigarreau.—This is commonly known as the "Royal Ann," and needs no comment.

May Duke.—A very early variety; tree an upright grower; very hardy; adapted to nearly all locations; fruit heart shaped; color red, changing to nearly black when fully ripe.

Late Duke.—A very valuable variety, as it comes in after all others have matured; an excellent fruit for canning; tree makes a spreading growth; a great producer; in season from middle of August to the first week in September; fruit red, turning to nearly black when fully matured.

Black Tartarian.—Fruit large; heart shaped; surface uneven; tree an erect grower; a general favorite.

All these varieties of cherries may be relied upon as standard sorts.

NOTE.—Of the newer varieties, which Professor Coote has not reported upon, are the Oregon, Bing, Hoskins and Lambert, all of Oregon origin, extra large fruits, mostly dark color to black, and excellent in every particular; also the well-known Kentish, one of the finest of sour-sweet cherries grown, and very prolific.—[Dosch, Editor.]

NUT CULTURE.

By Henry E. Dosch.

Give fools their gold, and knaves their power;
Let fortune's bubbles rise and fall;
Who sows a field or trains a flower,
Or plants a tree is more than all.
—J. G. Whittier.

To be invited to deliver an address or read a paper before any society or at any meeting is an honor at all times, but to receive an invitation from the regents and faculty of such an institution as this one, is doubly so, and I assure you the honor conferred is highly appreciated and valued by me.

There are two kinds of trees which have a special charm for me. One is the lordly pine and the other the royal walnut. Though a great lover of all nature, and an admirer of all trees, these two stand head and shoulder above them all in my humble estimation. He, or she, who never wandered among the pines, inhaling the fragrance of its needles and invigorating ozone, or who has never listened, while reposing in its shade, to the whispering spirits in its topmost branches, so soothing, has missed one of the greatest pleasures given to mankind by an all-wise Providence.

"'Older than Stradivarius,' you say,
Greater than all Amati's art?
Where did you find it? What did you pay?
Only the gold of an artist's heart,
Scattered with liberal hand and free;
Only a reverent ear bent low,
When across the strings of an old 'Pinetree'
The maestro Æolus drew his bow."

While the royal walnut in its grandeur, its strength, its inspiring nature, is ennobling and elevating and imparts a warm, inviting and dignified appearance to any home-place.

Wherever you see a walnut tree in a dooryard, you may rest assured that warm hearts dwell within, and you are equally assured a hearty welcome in a hospitable home.

Note.—Lecture delivered to the students of the "Farmers' Short Course," given under the patronage of the faculty of the Oregon agricultural college at Corvallis, by Henry E. Dosch, member of the state board of horticulture.

The English walnut, or rather French walnut, for the other is only a commercial term, is to the orchard what the rose is to the flower garden; ever fragrant, ever charming, whether in leaf, in bloom, in fruit, or in winter denuded of its foliage.

You may think me an enthusiast. Possibly I am, but if you wish to succeed with either tree, shrub or flower, you must love them, and raise them as you would a child. It may be a little more trouble, but the result will more than justify the loving care, labor and time.

There are orchards in Oregon which look like their owners loved them truly, and some which remind me of "Topsy" in "Uncle Tom's Cabin." They were not raised, but, like "Topsy," "jes' growed," weeds, sprouts and all.

When, some years ago, I retired from business and bought the out of town place on which we now live, my first thought turned to the cultivation of the French walnut, though the place had been cultivated for over forty years, and had all the other varieties of fruit growing. Knowing little or nothing of the habit and growth of the French walnut, except that when we were boys, we thought our neighbor's walnuts better than our own, I began to read up and to inquire of those whom I saw who had large walnut trees growing, but was informed that Oregon was not a nut-bearing country, as some of these trees were thirty years old and had never borne any fruit. I concluded that there must be some reason for this, as I could not convince myself that a country which grew every kind of fruit to such perfection as Oregon, having all the advantages in soil and climate that France and Germany have, where the English walnut flourishes abundantly, could not grow that royal fruit, and soon learned that the variety planted here was the Los Angeles, the most delicate walnut grown, which thrives on this coast only in a few counties of Southern California, brought there by the Friars of the early Spanish settlements.

Feeling that there must be other varieties, I wrote to a grower in California who makes a specialty of nut-bearing trees and who first introduced the hardy varieties of French walnuts, for trees which he thought best suited to our climate and of such large size as he could recommend to transplant and do well. He sent me five-year-old trees of second generation, Præparturiens and Serotina varieties, which were duly planted with utmost care and every attention given afterward, but did not seem to do well. Over half of them died after struggling along a year or two, and for four long years after planting, the remainder stood still, all of which was caused by the cutting of the large taproot. What few lateral roots they had were barely sufficient to keep them alive. But last year they made some headway and bore a few nuts, which shows that the trees had finally established themselves. It was a great mistake. Had I planted yearlings I would have had better results, which I only learned, however, by actual experience. I have some three-year-old trees transplanted at yearlings which

have as large heads and are nearly as far advanced as my nine-year-old trees are, which were transplanted at the age of five years.

All nut-bearing trees, as is well known, have a taproot and very few lateral roots. Now, it stands to reason that when a tree is small the taproot also is small, and will not be mutilated in transplanting, but I also learned by actual experience that the lateral roots of a properly-grown yearling are nearly as large as the lateral roots of a five-year-old tree; hence, when transplanted, the top of tree being small, about 6 to 12 inches, will have plenty of nourishment and support from both the lateral and taproots, and unquestionably make a better and stronger tree than one whose taproot has been cut off, notwithstanding the assertion of some nurserymen, that it makes no difference whether the taproot is cut off or not. Nature knows best. A yearling walnut tree that has made a top growth of from 6 to 12 inches, has a taproot of from 15 to 30 inches. If it did not require a taproot, you may be assured nature would not have put one there.

If it were not for the retrogration of the walnut when planted from common seed, I would advise the planting of the nut where the tree is to grow, but as we are told by those who have made walnut culture a life study, that few varieties will prove true to seed, we are compelled to buy the trees from those who grow from the nuts of grafted trees, or, as they are called, second generation trees, which are grown from the nut of the original grafted stocks.

The rolling hills and slopes of Oregon seem especially adapted for walnut culture, and there is no good reason why we should not raise at least all the nuts used in the Pacific northwest. Remember, you have a large territory to supply. Those who were here in the days of old, the days of gold, the days of '49, will remember the many nut-stands in every mining camp, many of which still exist in Montana, Idaho and even Oregon. Again, large quantities are used as dessert fruit, but more particularly the demand is for candied nuts, which latter has developed to very large proportions in the east. From recent reports, the imports of last year from France and Germany amounted to $5,000,000, so there is no danger of overstocking the market in the near future.

In France and Germany large quantities of nuts are pressed into oil and sold all over the world as "olive oil," the residue, or oil-meal, being sold as feed for milch cows and other stock. What can be done there, can also be done here; the market for this product is right at our orchard gates, and for many years will be very meagerly supplied with the home-grown article.

As to varieties to plant suitable to our climate, I would name second generation Prœparturiens, Serotina, Mayette, Franquette, Parisienne and Columbus, and possibly the improved soft-shell walnut. The latter is claimed to prove true to seed and is growing nicely with me, but not yet in

bearing, and may not be adapted to our climate, being considered rather delicate and tender.

Having made your selection of trees, put the place in which you wish to plant them in perfect order, dig the holes three feet wide by at least two feet in depth and thirty feet apart, then fill them up again, bottom soil on top, all of which can be done in the fall and winter and be ready in spring for planting, which is a very particular piece of work. Taproots straight down, spread out each lateral rootlet carefully as you proceed to fill the previously reopened hole, sifting in fine dirt as you go, the tree to stand a little higher than in nursery rows, thus allowing for settling down, and when completed you may rest assured your trees will grow, and beyond cultivation, require no further attention; no spraying and no pruning, except in the beginning; cut off all side branches until the main stock has attained a height of five feet, then allow to branch out without cutting off the top.

However, if you wish to experiment as I have done, by planting the nuts, procure them in the fall; fill some boxes with light soil and sand, half full, then put in the nuts, pointed end up, about one inch apart, cover three inches deep, and place out of reach of rats, squirrels and gophers, keeping the soil moist; on examination in the early part of April you will find that they have sprouted; that is, they throw up two sprouts from the pointed end of the nut. One of these turns down over the nut and forms the taproot, and the other continues upward and forms the tree. Now remove them very carefully, as these sprouts are very brittle and easily broken, which would make the plant worthless. Plant them either where you wish the tree to grow (by far the best way) or in nursery rows about five inches deep, and transplant the following spring.

There is no fruit tree that is so indifferent to location, exposure or soil as the English walnut. It gives good results even on land not fit for any other use; but is grateful for better soil, by going into bearing sooner and yielding larger crops, provided there is a loose or gravelly subsoil.

Walnuts usually go into bearing in five or six years; at twelve years are in full bearing. In Ventura county, California, trees of the latter age are said on undoubted authority to have yielded from $15 to $20 worth of nuts. It is not a slow grower, as I have been led to believe; four to six feet is not an uncommon growth in one season; besides, it is a healthy tree, having, comparatively speaking, few pests to molest it; and once established, lives to a good old age and proves profitable to generation after generation with but little care. The walnut is very difficult to graft, which is owing to the rapid evaporation from the scion while the slow process of uniting with the stock is going on, which also accounts for the very high price of grafted trees; in latter years shield budding has been practiced with gratifying results.

This year I planted 300 yearlings of my own growing and have now

sprouting about 500 more of English walnuts, butternuts, hickorynuts and pecans.

Among the other nut-bearing trees with which I am experimenting is the pecan, a native of the land known to us when boys as "Dixie Land." The pecan is very unlike the English walnut, as it requires rich soil and does best when grown on bottom lands along rivers and creeks, and delights particularly in bottoms that are subject to overflow. It is a stately tree and when properly planted will grow as gracefully as a southern belle. Like all nut trees, however, it is very difficult to transplant; even more so than the English walnut, as it has a long, straight taproot, and no lateral roots worth speaking of, and in this particular it resembles the shell-bark hickory, hence the nut should be planted where the tree is to grow, though transplanted when very small will do. The pecan, known as the Louisiana or Texas pecan, produces nuts when grown from seed, of irregular size, and to avoid this the usual method adopted is to plant the nuts where the tree is expected to grow, and when sufficiently large either graft or bud (without disturbing the roots) from trees known to bear large-sized and uniform nuts. Seedlings often produce very nice fruit. There are varieties which are claimed to prove true to seed, such as the Van Deman and Stuart, originated at the Stuart Pecan Company's grounds, Ocean Springs, Mississippi, which are doing nicely with me, being large and exceedingly fine and nutty.

The pecan is a true bearer, and it is claimed that a tree yields under fair conditions, when in full bearing, from ten to twenty dollar's worth of nuts. They generally go into bearing at the age of seven years, and when once established require no care whatever, not even cultivation; in fact, it is stated that they do better when the land is sown to grass and pastured; however there is quite a difference of opinion on this subject, later authorities claiming that cultivated groves bear larger and finer nuts. Those that I am now raising were grown from seed and transplanted as yearlings.

"Under the spreading chesnut tree
The village smithy stands."

What a beautiful thought, but no doubt you are familiar with Longfellow's poem. He could not have selected á better one, for a chestnut tree is a poem in itself.

There are many good and well-established varieties in Oregon, but there are some superior to others; one of these is the Grosse Precose, sure bearer, rapid grower, prolific and healthy tree; nut good size and sweet, all good points. The Combale comes next, and then the Paragon, Quercy, and Nouzzilard. The American Sweet is too well known to require description. These are all grafted trees, as seedlings are very indifferent as to fruit, and should be planted and treated the same as the walnut. The market, how-

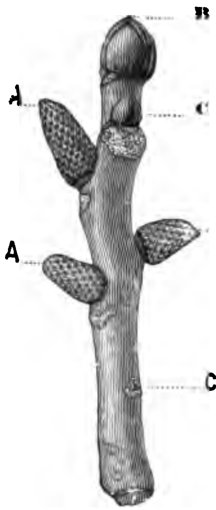


FIG. 1.

Staminate and pistillate buds of the walnut, in a dormant state.
A—Staminate bud.
B—Pistillate bud.
C—Leaf bud.

FIG. 2.

Staminate bud of the walnut, or catkin, in full bloom, or male blossoms.

FIG. 3.

Pistillate bud of the walnut in full bloom, or female blossoms.

Walnut blossoms of natural size and "from nature," as grown on Second Generation Prœparturiens trees, on Barren Hill, Nevada City, California, by Felix Gillet.

ever, for this fruit is more limited, but for family use it is unsurpassed for flavor or nourishment, whether roasted, used as a vegetable, or as a stuffing for fowls.

Almonds do exceedingly well in Oregon, the Grosse Tendre or Languedoc, being however the only one adapted to Northwestern Oregon, and the only one which bears prolifically with me, while the Princess, I. X. L., and Nonpariel do very well in Southern Oregon. However, they do not thrive where there is much fog.

From a commercial standpoint these nut-bearing trees are not only valuable for their fruit, but also for their wood. Everybody is familiar with fine walnut furniture, and costly at that, particularly what is known as French walnut veneering. Pecan timber especially is susceptible of a very high polish, having a fine grain, and is exceedingly handsome for finishing either furniture or for paneling in housework.

I endeavored to obtain the exact figures of importations into Oregon of all kinds of nuts, but failed. The various wholesale merchants, however, who deal in them tell me that between $300,000 and $400,000 would come very near to the amount annually expended.

In conclusion, I beg to say that I have demonstrated to my own satisfaction that the English walnut will do well here and bear fruit in paying quantities, and hope that I have been sufficiently explicit in this paper to induce others to profit from my experience. If you cannot or will not plant a grove, try a few trees, and I am confident that you will never regret having planted the English walnut.

Since the foregoing paper was written, now nine years ago, I received many letters of inquiry regarding nut-culture, and I know that some trees have been planted in an experimental way which have done exceedingly well, but I know of only one planting in a commercial grove, consisting of 40 acres of French walnuts and chesnuts, though there is another near Portland, on a gravelly hill, of 300 trees, and one near Eugene of some 400 trees, besides my own; so there is an almost unoccupied field which promises equally as good returns, if not better, than any other kind of fruit by way of intensive and diversified farming. This is now well recognized and understood in the east since the wild nut-bearing trees, which grew so plentifully, have been cut down wastefully and used for posts, fences and firewood, and the scarcity has become so marked that attention has been called to it by the trade, and many new plantings are now being made. When I first planted my own, in order to thoroughly satisfy myself as to the adaptability of our soils and various climatic conditions, I gave away 200 yearlings, trees of my own growing; I sent them to friends in various parts of our state; to Eastern Oregon, Southern Oregon, the coast counties, our own Willamette valley, and even to the sound, and the reports received have

been most gratifying. Last summer I saw some of these trees, which had grown to a height of 20 feet, with a spreading top of 14 feet, and measured seven inches in diameter four feet from the ground.

I have said that the walnut is most indifferent as to location or soil, whether clay, loam or gravel, and even rocky ground, provided there is a loose subsoil for the taproot to go down ; it is perfectly useless to plant nut-bearing trees where there is hardpan subsoil, a fact I did not know when I planted my trees, for I find that I have only twelve inches of clay soil, and then comes that impenetrable hardpan ; were it not that five feet under this hardpan is a vast ledge of iron rock, I would even now dynamite the soil, to break up this hardpan, so that the taproots might strike down. Instead of having a beautiful grove of five hundred bearing French walnuts, pecans and hicorynut trees, I have only so many stunted trees, which it will take many years to get into bearing; as nut-bearing trees make very few lateral roots, which grow very slowly, hence the trees must naturally grow slowly in proportion, for the taproot stands still as soon as it strikes hardpan. I assure you it is a great disappointment to me, though I am very much pleased to know that my friends who had loose soil, and in consequence better success, all of which are now in bearing; in fact, I gathered over 20 pounds of nuts from one eight-year-old tree on a friend's place which, at 15 cents per pound, will bring $3 to the tree. My own trees, some of which are now 14 years old, bear some very choice nuts, but owing to my soil condition, not in paying quantities.

I said that there were trees 20 years old which have never borne any fruit, and upon study I learned that it was on account of imperfect or rather no pollination, for the staminate bud or male blossom appeared, matured and dropped off some six weeks before the pistilate buds or female blossoms, which produce the fruits, made their appearance; hence, when the embryo nuts attained the size of a pea they very naturally dropped off, not having been fertilized ; but those which I have named are late and perfect bloomers, yet I would advise to always plant the different varieties in alternate rows, for it is a well understood law of nature that no matter how perfect a bloomer a tree may be, if the pollen from another variety is introduced the fruit is much more perfect, for instance, a Mayette for a Parisiene or Franquette, and *vice versa.* (See plate.)

In speaking of the cutting of the taproot, I said it was a mistake, which created a controversy at the time, even from California, and many said the tree did not need the taproot, that they would grow without it, and I said they would do nothing of the kind, for I never knew nature to make a mistake; so I dug down beside those five-year-old trees and found that the trees were growing a new taproot, and some of them even two, which was the cause of my trees standing still, and did not make any top growth until these taproots were grown, which took four years, while some died

First Generation.

Second Generation.

Third Generation.

Fourth Generation.

outright, as it took more vitality, then these trees had to grow another tap-root and sustain the top of the tree as well.

In raising trees from nuts, I said that if it were not for the retrogression of nuts when successively planted from seed, I would recommend to plant the nut where the tree is to grow. I inquired deeply into this subject and learned, that when we obtained the nut from the original grafted trees they reproduce themselves of same size and then retrograde, but owing to our peculiar soils and climatic conditions on the Pacific coast the trees which are called second generation, if produced from the nuts of the original grafted trees or first generation, yield fruit about one third larger than the original and then retrograde very rapidly. (See plate.)

I have endeavored for years to induce our nurserymen to grow second generation trees of named varieties, instead of the worthless stock, without avail, however, until I got a scientific nurseryman to import a lot of first generation nuts and he has growing now a fine lot of second generation French walnut trees.

This subject of retrogression is very little understood even by the California growers. At the Columbian exposition, held at Chicago some years ago, I exhibited jars containing the four generations of nuts, and Mr. Lewis, our superintendent, wrote me that these jars attracted a good deal of attention; especially California walnut growers seemed very much interested, and Mr. Blodgett, the largest walnut grower on the coast, told Mr. Lewis: "Now I understand why some of my trees bear such small nuts; tell Mr. Dosch that this is worth thousands of dollars to me; have him pay me a visit and stay as long as he pleases." It may be interesting to you to know that I received the diploma and medal. You can buy first generation nuts of given varieties from Andrieux, Vilmorin and Company, Paris, France, the largest seed house in the world. Mr. Felix Gillet, of Nevada City, California, the father of French walnut culture on the Pacific coast, writes to me under date of May 28:—

"Walnuts on my place never looked nicer than they do this year, and I never saw on them so many catkins; two of my largest trees, a Cluster and a Serotina, looked so pretty while out in full bloom with thousands of catkins on that I had a photograph taken of each tree for photo engravings; I expect to have sixty pounds on my Serotina tree, and a thousand nuts on Cluster Racemosa, and my grafted Mayette and others might yield enough nuts so that I would not have to import any from France; all my walnut trees look fine, so loaded with nuts."

In this connection, permit me to state that I receive many letters from persons desiring to buy nuts or trees from me, and when I tell them that my walnuts coming from second generation trees would produce trees of the third generation and hence not desirable, neither had I trees for sale, that what I had done to introduce nut-bearing trees into Oregon was partly for my own pleasure and partly for the benefit of the Oregon horticulturist,

they seem incredulous, unable to understand that anyone could do something for his fellow-man without being paid for it.

Speaking of the commercial value of walnut wood, allow me to mention one instance. Some thirty years ago a Mr. Wrights planted forty acres to French walnuts in Southern California, twenty feet apart. When the trees were beginning to crowd each other, being then about twenty years old, he had every other tree cut out and he sold them for $72,000, thus bringing more than the land cost originally with compound interest on the improvement, together with the cost of the trees, labor, etc., besides the sale of nuts of these trees for twelve years or more, and then having left a most valuable piece of property, yielding a large yearly income.

You may wonder why I have not mentioned the Japan chestnut, so much advertised and forced by eastern nurserymen and seed merchants. Allow me to tell you that I never saw any fruits come from either China or Japan, whether they are apples, pears, persimmons, wineberries or nuts, that are worth planting. The only thing we get from these countries worth having, especially Japan, are their evergreen shrubs, and they are not excelled anywhere.

Harvesting a walnut crop is an easy matter, as the hulls crack open and the nuts fall to the ground when ripe. When about one half have fallen they should be picked up, and when most of the remainder have fallen, the trees may be shaken, or the nuts knocked down with a pole, clearing the orchard in twice going over. When gathering, any hulls that are still sticking must be removed and then put in sacks or orchard boxes to haul to the dryer, if a wet season, or open ground if warm, clear weather prevails, place them on trays, same as prunes, and dry well, turning them over each day, if dried in the sun.

Sulphuring is practiced to some extent to supply the demand for bleached fruits, a most pernicious method, and I say to you, don't do it, unless the customer to whom you sell the fruits desires it done and prefers spoiled to clean, healthy, wholesome fruits.

I used the expression "intensive farming." We have reached the era where the old adage of the "survival of the fittest" comes in; whatever you do, do it intensive, whether it is your studies or, in after life, your chosen vocation. Let the word "intensive" be your motto.

Be intensive in the duty you owe to yourself;
Be intensive in the duty you owe to your fellow-man;
Be intensive in the duty you owe to your country as a citizen, and
Be intensive in the duty you owe to your God.

Prœparturiens or Fertile walnut, second generation.—This famous variety of the *Juglans regia* family was introduced by us into California in the winter of 1870-71; and in our grounds, 2,600 feet up the Sierras, are the first

"SECOND GENERATION" PRŒPARTURIENS WALNUTS.

trees of that kind that ever produced fruit in this state. Second generation nuts are, in the average, much larger than those of the first and third generations, 75 per cent. being from medium to large and 25 per cent. from small to medium; all are perfect soft-shell and of first quality. The Prœparturiens is one of the most productive kinds, and bears large crops from the start, hence its first name of Fertile.

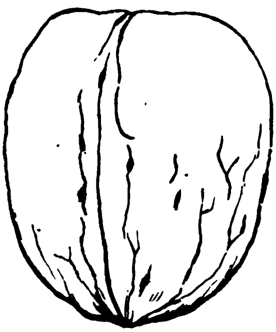
Mayette-shaped Prœparturiens.—Nut large, sitting on its big end like the Mayette, hence its name. Full-fleshed kernel of first quality; heavy bearer. Solely propagated by grafting.

Third generation Prœparturiens.—The kind of Prœparturiens so common in California, and sold as genuine Prœparturiens. It is grown from nuts borne on second generation trees. Third generation Prœparturiens trees have but few of the characteristics of the original left, except its good bearing qualities. The nut is generally small—too small for market—though very thin-shelled and of first quality.

Cluster walnut (*Juglans racemosa*).—This remarkable kind of walnut, also introduced years ago by us into this country, is a worthy rival of the Prœparturiens; it derives its name from the Latin word *racemosus*, meaning abundant in cluster, full of clusters, which is the main characteristic of Cluster walnut, whose nuts, when the tree is in full bearing, grow in clusters of eight to fifteen nuts and even twenty to twenty-eight. The Cluster, like the Prœparturiens, reproduces itself well enough from seed, provided the nuts be gathered from trees grafted from the original. Our trees are all second generation trees, with probably a percentage of 80 per cent. true, that is, of having retained that particular characteristic of the variety, of growing long clusters of nuts. The nut is thin-shelled, from medium to large. As a matter of course, the trees have to be old enough to bear large clusters

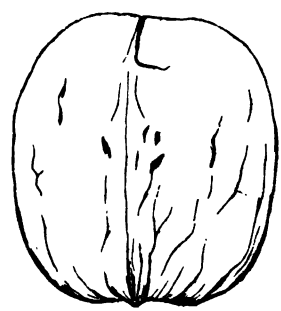
of nuts. The nuts of grafted trees are real beauties, with the end hermetically closed and a smooth, well-shaped shell.

Mayette walnut.—This is one of the finest dessert nuts grown; it is quite large and uniformly so, well shaped, with a light-colored shell; the kernel is full-fleshed, sweet and nutty. But what renders this remarkable kind so much more valuable is to be very late in budding out, which enables it to escape the disastrous effect of late frosts in the spring; it is an abundant bearer. This is the nut imported into the United States under the name of Grenoble, but on account of the duty of three cents per pound, as the nut is a high-priced one in France, a common and cheaper grade is mixed with it, to the disgust of nut-importers in New York and Chicago. The Mayette was originated by a man of the name of Mayet, about one hundred and twenty-five years ago, the nut having ever since been a great favorite.



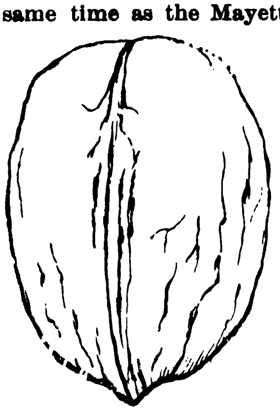
MAYETTE.

Parisienne walnut.—This beautiful nut, also one of the finest for dessert and market, was originated in the southeast of France, and not in the neighborhood of Paris, as its name would imply; its beauty made it called "Parisienne," in honor of the capital of France. The nut is large, broader at the small end than the Franquette, and has a very pretty shape. It is as late and hardy as Mayette.



PARISIENNE.

Franquette walnut.—Originated about the same time as the Mayette in the southeast of France, by a man named Franquet. It is quite large, of an elongated oval, and very attractive; kernel full-fleshed and sweet. It buds out late in the spring, and has never been injured by frost on our place, though quite high in the mountains.



FRANQUETTE.

Vourey walnut.—This new and valuable kind is of recent introduction, and was originated near Vourey, in the southeast of France, hence its name. It resembles in shape the Mayette, and is one of the hardiest kinds introduced by us into this state. The nut is somewhat smaller than Mayette.

Serotina, or late walnut.—We find this variety to be so late in budding out as to not be injured by late frosts in the spring. The nut is of medium

size, well-shaped, with a very sweet, nutty meat; heavy bearer. It is this variety that from the seed produces the "After Saint John" walnut, budding out on Saint John's day (twentieth of June). The "After Saint John" is a small nut.

Chaberte walnut.—An old and most valuable variety; late in budding out. The nut is well shaped, roundish oval and of fair size, though it is not what is called a large nut; the kernel is of extra fine quality; good bearer. The Chaberte was originated over a century ago by a man named Chaberte, hence its name.

CHABERTE.

California Chaberte.—This most pretty nut, the sweetest raised in our grounds, has been originated by us from a nut borne on a grafted Chaberte. This nut is only of medium size, shell very thin and of light color, which gives it a fine appearance. The kernel is full-fleshed, exceedingly sweet and nutty, with a pelicle of a very light yellow or cream color. Propagated true only by grafting.

NOTE.—The descriptions of these nuts are taken from the catalogue of Felix Gillet, Nevada City, California.

FIG CULTURE IN NORTHWESTERN OREGON.

By A. T. Hawley.

To a certain extent the taste for the fig in its ripe state, just plucked from the tree, is a cultivated one, especially among those who have not been accustomed to its use from chilhood. Nevertheless, it may be asserted with truth that no more delicious or kindly fruit grows. To eat it in its perfection one must needs find it in is natural habitat, where all the climatic influences necessary to its complete development are part of its surroundings. I have eaten it in Tennessee, Louisiana, California and Oregon. As far north on the Atlantic coast as Maryland it is cultivated, and so highly is it esteemed in that section that assiduous attention is paid to its protection in winter. It is the custom there, at the approach of cold weather, to bend the bushes over, for it does not attain to the dignity of a tree in that section, and cover them with earth or mulch for their protection from frost and ice.

Apart from the mere pleasure of eating the fruit, either just as it is taken from the tree or smothered in cream with an addition of powdered sugar, and, perhaps, a little sherry or Maderia wine, its value from a hygienic or dietary standpoint is a matter of world-wide recognition.

Nearly twelve years ago, during my first trip through the Willamette valley, I made inquiries as to whether any attempt had been made to cultivate the fig in this section, but received no satisfactory replies. I went to Puget sound and remained until 1885.

OBSERVATION FIRST.

In 1886 I was a sojourner in Salem, Marion county, and during the summer I saw in a show window of one of the stores a plate of remarkably fine figs, of a white variety, nearly as large as a goose egg. Being referred, on inquiry, to the grower, Capt. L. E. Pratt, I learned from him that they were the fruit of some bushes which had stood in his yard, barren for several years, but which had fruited that year for the first time.

I suggested to him that he subdivide the bushes and enter upon the work of "stocking" the valley with acclimated fig trees. He took my advice to a limited extent and planted forty or fifty slips. The next winter brought "a killing frost" and parent stock and rootings were killed to the

ground. The next spring all "renewed their youth," but were barren that summer. The next year the parent stock fruited liberally and Captain Pratt reported the fruit delicious.

OBSERVATION SECOND.

Some two years ago I saw a well-developed fig tree in a yard on the corner of Second and Main streets, Portland. I took the liberty of ringing the house door bell and asking the history of the tree. I was informed that it had borne liberally two or three times but had been winter-killed more than once, and that each killing had been followed by renewed growth from the root, and that each renewal of growth had been followed by one or two barren years.

OBSERVATION THIRD.

To my agreeable surprise I saw at the great exposition of 1889 at Portland two plates full of the small, round, white fig, which I had so often feasted on with delight in Louisiana, thirty-eight years ago. I traced them to the houseyard of Mrs. George W. Bell, at No. 365 Front street, Portland. Although the tree occupies an exceptionally favorably position, being located in a sort of *cul de sac* of the house, by which they are sheltered from the east and north winds and get the full benefit of all the sunlight, the winter has got the best of it once or twice and a barren year has followed each time.

The following conclusions can be deduced with absolute certainty from my observations:—

1. Figs of fine varieties can be grown in this section of the state.

2. The most intelligent care must be exercised in the selection of localities for planting.

3. Absolute protection against the frosts and ice of our infrequently severe winters must be carefully provided for.

4. From judicious planting and cultivation of the slips and cuttings of the acclimated and naturalized trees or bushes already referred to, if the owners thereof could be induced to go into the business, the shade of the fig tree as well as of the vine could in a few years become a universal feature of a Western Oregon landscape.

I am aware that there are other fig trees in this section of the state, but they have not come under my observation. But what I have said ought to be sufficient to awaken a widespread interest in the matter, and I commend the whole subject to the careful consideration of the state horticultural society.

I do not claim or believe that any great financial profit will ever be made from fig-culture in this section of Oregon, but the value and beauty of every homestead in this section can be greatly enhanced by introducing this healthful and delicious fruit.

Some interesting suggestions on the subject of fig-culture in Douglas

county are to be found in the paper contributed to this pamphlet by Dr. Oehme, of Roseburg. I am informed that somewhat extensive experiments are being made in the same direction in Southern Oregon, but I have no data at hand as regards this section to refer to.

I transcribe the following on the subject of fig-culture from the report of Dr. Gustave Sisen, a prominent nurseryman of Fresno, California, made to the California state horticultural society:—

1. Abundance of moisture in the soil before the figs begin to ripen.
2. Good and perfect drainage at all times.
3. The gradual drying of the soil when the fruit is ripening.
4. Sufficient heat to insure sweetness in the figs.
5. Absence of frost lower than 18 degrees Fahrenheit, though the figs can stand a temperature as low as 12 degrees Fahrenheit, if they are tolerably dormant.
6. Absence of heavy rains during the maturing of the fruit.

The following conditions are injurious to fig trees if the object is to procure superior fruit:—

1. A wet soil, with stagnant water during the fruiting season.
2. Cesspools, sewers and ditches in such close proximity that the trees can send roots to them.
3. Heavy rains on the fruit when it is ripening (something not likely to occur in July, August and September in Oregon, when the fruit at Salem and Portland, which I have seen, ripens. — A. T. H.)

And lastly, says Dr. Sisen: "Avoid planting in a heavy, undrainable, black, adobe soil, impervious to sun and air."

As I remarked some months ago, in a paper on this subject, contributed by me to the Oregonian: "There can be no doubt that nearly all, if not all, the favorable conditions mentioned by Dr. Sisen can be met with in many portions of Northwestern Oregon." And I am inclined to think, proper attention being paid to the subject, that there are many localities in Eastern Oregon which are well adapted to fig-culture.

The managers of the experiment station at Corvallis ought to take this subject in hand. They ought to procure as many cuttings as possible from Salem and Portland fruiting trees, or from fruiting trees elsewhere in this section, and root them, and the next year subdivide them, and continue the work year after year. Five or ten years at the most ought to see the Willamette valley well stocked with this delicious fruit.

To those who intend planting, I would say: Select a warm, friable loam not too sandy. Plant on the south side of house or barn to protect from north or northeast winds. If not convenient to do this, the south side of a well-trained, thick-growing blackberry or raspberry row will answer the purpose to some extent. Put yourselves to the trouble of protecting the trees in winter. Tarred paper or burlaps, wrapped and tied around the trees, will serve a good purpose. Mr. Whitman, of Southern Oregon, suggests stacking

corn stalks around them, a method he has seen tried with success elsewhere.

I have suggested in this paper that the managers of the experiment station confine their work to cuttings from trees that have fruited in Northwestern Oregon. I do so because I think that trees or cuttings brought from warmer climates require several years to adapt themselves to the new climatic conditions they find here.

Captain Pratt's trees in Salem stood in his yard several years before they bore fruit in 1886. But for their beauty and novelty as an exotic shrub they would have been "cut down and cast in the fire."

In conclusion, I do not hesitate to say that no more delightful and valuable addition to the fruits of this already high-favored section could be made than the fig, thoroughly acclimated and naturalized. And there is no reason why a complete and gratifying success should not be made in this direction. The figs in Captain Pratt's Salem garden, and at No. 365 Front street, Portland, are choice varieties. They ought to be kept true to the parent stock, and widely distributed from the Calapooias to the Columbia river. Other varieties would doubtless succeed after proper endeavor has been made. But those mentioned are an "achieved success," are here to stay and should be made much of.

THE CHERRY.

By L. T. Reynolds.

The cherry tree may be grown in all parts of this state, yet it especially delights in a deep, rich loam underlaid with gravel or sand. It does not thrive so well when there is a clay subsoil. Where well situated, the cherry trees often attain great size and bear heavy crops. We have in our dooryard a tree of the Napoleon or Royal Ann variety, which is twenty-five years old, measuring seven feet in circumference. It is thirty-six feet high, has a spread of branches of about thirty-eight feet and has sometimes borne one thousand pounds of cherries.

The May Duke and Morello cherries will thrive under nearly all conditions and on all soils, while the Hearts and Bigarreau are not so easily grown. For home use, therefore, one should always plant a tree or two of the May Duke, Late Duke and the Kentish or Early Richmond.

While the cherry is easily grown and usually does well in the home garden, yet when planted in the orchard, considerable trouble is often experienced during the first five or six years, owing to their liability to gum. Without entering into a discussion of the causes of this gumming, or gummosis, as it is usually called, a few methods may be recommended which may serve to check in a measure some of the worst forms of this malady. Pruning should be done very carefully, removing large limbs only when absolutely necessary. If properly started, the cherry will not need much pruning after the fifth year. Thereafter, all that is required is to remove diseased branches or those that cross. After the fruit is gathered in summer this pruning may be done, the trees being liable to gum at this season. In forming the head of the young tree the branches should be trained to grow out at as near a right angle as possible, as this assists in preventing gum in the crotch of the tree. When gum pockets form they should be carefully cut out with a knife and the wound painted with shellac and alcohol varnish or grafting wax.

If we can secure resistant stocks much would be accomplished toward the prevention of gumming. In the growing of seedling stock the seeds of the common Black Mazzard cherries are generally planted. These produce thrifty, free-growing seedlings and are preferred to other stocks. The Mahaleb seedling is often used in the east for the purpose of dwarfing, but it seems not to have that effect on this coast. The seeds of the Morello cherries

are sometimes planted and produce fairly good stocks. What is needed is a hardy stock that will not gum, and we believe the cherry stocks should be top-worked, that is, should be budded or grafted eighteen to twenty inches from the ground, where the head is to be formed. Owing to the greater hardiness of the seedling stocks, this method seems to produce a tree better able to resist disease and much less liable to gum. Experiments are now under way which thus far have indicated that this is the proper method of starting cherry trees, though two or three years may yet be required to fully demonstrate this. After the first few years we consider constant cultivation of the cherry rather injurious, since it generally stimulates too rank a growth and very often results in excessive gumming. If cultivated, it should be very shallow and not too often.

The diseases to which the cherry is subject are similar to those of other stone fruits and treatment is the same. The roots are frequently affected with the root-knot. These knots should be cut out and the wounds covered with bordeaux mixture. The most common diseases are the brown rot (*Monilia Fructigena*), and the shot-hole fungus (*Cylindrosporium Padi*). These fungus diseases may be kept in check by spraying with a dilute solution of bordeaux mixture. While not especially subject to the attacks of insect pests, the cherry is often damaged by caterpillars and other leaf-eating insects, and is sometimes infested with borers, the remedy in all cases being the same as that given for these pests on other fruits. We have seen great damage done to cherry orchards by the pear-tree slug, whole orchards being sometimes defoliated by this slug, which, in the case of cherry trees, works on the under side of the leaf. When this occurs it is due to neglect, as they may be easily destroyed by spraying the leaves with a solution made of three ounces paris green to 50 gallons of water, adding a little lime to prevent burning the leaves. The cherry is quite productive, and ripening, as it does, early in the season, and immediately following the strawberry crop, it should prove a profitable crop to those who are situated near canning establishments. With the building and operating of canneries, which are sure to come in the future, will arise a demand for those varieties of cherries which are suitable for canning, and this fruit will, no doubt, receive a larger share of the attention of orchardists than it now commands. Up to the present time growers who have produced large quantities of cherries have found little demand for their crops, owing to the limited local market. With the advent of canneries, however, and with better and cheaper facilities for shipping this delicious fruit, cherries should prove as profitable as any other fruit.

During the past season, owing to the limited market for fresh cherries, the writer conducted some experiments in the evaporation of different varieties. In drying several thousand pounds of cherries, it was found that 2·7 pounds of ripe Black Republican cherries were required to produce 1 pound of the evaporated product. The Royal Ann required 3 pounds and

the May Duke required 4·2 pounds to produce one pound dried. These cherries were evaporated without removing the pits. While there is at present no established demand for evaporated cherries, yet such is their excellence, that when properly introduced, we believe there will be created a permanent demand for them. With evaporated cherries, as with all other fruits, a thorough understanding of their cooking is necessary to produce a choice and pleasing article of diet. More than other dried fruits they retain their original size and plumpness, and while the flavor is not that of the fresh fruit, it approaches it more nearly, and is richer than when canned. The most essential element in their preparation for cooking is a thorough soaking, for at least 12 hours, in sufficient water to completely cover them; after this, they should simmer for several hours and then be brought to a boil for a short time. When desired for puddings or other dishes, they are easily pitted after standing in warm water for a short time.

For canning cherries, the white or light-colored varieties have the preference. For this purpose the Royal Ann, Rockport, Bigarreau and other similar cherries are excellent. The red and black cherries are in most demand as dessert and shipping fruits, and of these, some of the best varieties have originated in this state. Such are the Black Republican, Bing, Lambert and Hoskins cherries. Following are descriptions of late cherries which have originated in Oregon, as given in the year book of the United States department of agriculture for 1892.

"*Bing*.—(Seth Lewelling, Milwaukie, Oregon.)—Fruit very large, broad, heart-shaped, compressed, slightly angular; surface, bright, glossy; color, very dark crimson to black; dots, numerous, often elongated; cavity, broad, stem long, suture very broad, apex slightly depressed; skin, thick, very firm, but not tough; flesh, deep crimson, very firm, juicy; flavor, vinous, sweet; quality, very good; season, first half of July in Oregon. Largest cherry ever received at this office. It is an excellent shipper. A seedling of Black Republican."

"*Hoskins*.—(C. E. Hoskins, Newberg, Oregon.)—Fruit, large, roundish, heart-shaped; cavity, round, regular; suture, a mere line; stem, rather short, set in a regular round cavity of medium depth; color, dull purplish red; dots, elongated; skin, medium; flesh, purple, with light veins, firm; flavor, sprightly, sweet; quality, good; season, medium. An excellent shipping cherry in Oregon. The tree is a somewhat spreading, upright grower, very vigorous, with large, coarsely dentate, ovate leaves, having two large reniform glands."

BERRIES AND THEIR CULTURE.

By Henry E. Dosch.

"Devotedness, lifelong, unflinching, entire, is the secret of success. However humble your work be, fear not to be devoted to it till the end. Bear every reverse, every discouragement, every trial. Let your devotedness be without reproach or question. Success comes late, by very slow approaches—nay, sometimes after the worker has passed away. But he who practices and teaches devotedness handles the lever that is sure to move the world in the end.—Mozoomdez."

In one of my papers I stated that every orchardist should grow berries by way of diversified fruit-growing, or as a by-product, so to speak. The labor and harvest coming before the larger fruits come into market and require all the fruit-grower's attention. They come into market when the farmer has little else to sell and brings in ready cash at a time when the exchequer is liable to be pretty low.

The demand for berries has never been fully supplied, especially of raspberries and currants, followed by the strawberry, for shipping to distant markets. Perhaps the first thing to be considered is proper location and soil suitable for berry culture. All berries do well here, as is evidenced by the fact that wild berries grow to perfection and in great abundance in every section of Oregon. While all soils are more or less adapted for the culture of berries, certain soils are more congenial than others. Mr. Thayer, the berry specialist, says on this point:—

SOIL FOR BERRIES.

"Clay soil must be well drained, is more difficult to prepare, matures later crops and not so favorable for winter protection. The ideal berry ground would be: *First*, a rich loam with clay subsoil. *Second*, a dark loam or gravelly loam mixed slightly with clay, and a clay subsoil, all having a southerly or eastern exposure. Any of these mixed soils will make good berry gardens by applying good barnyard manure, which contains all the essential elements required. When such manure cannot be obtained, then commercial fertilizers rich in nitrogen and potash should be applied. Avoid low, flat land unless under-drained; it is usually cold, late and more subject to frosts. Avoid steep hillsides as being more subject to drought and wash of soil by severe rains. Very few farms are without suitable soil and loca-

tion for a good berry garden and that farmer who simply exists year after year without a good garden has not learned the first principles of living."

THE CURRANT.

These luscious berries are always in great demand for all purposes, the culture of which has received a good deal of attention, there being two main differences; one preferring clear cultivation, the others mulching, but much depends upon whether grown in tree or bush form. Personally, I prefer tree shape, clean cultivation and the use of commercial fertilizer. The reason I prefer tree shape is that I can plant them closer, no sprouts and larger, finer berry clusters. The way to produce tree form is to cut one-year-old shoots, late in the fall, about fourteen inches long, then cut away every bud except three or four at the upper end and bury six inches deep in a cool, shady place to keep them dormant. In the spring when the ground is ready to receive them plant where they are to grow, deep enough so as to allow about six inches between the ground and the lowest bud; three feet apart in rows and five feet between rows. They will soon strike root and grow handsome heads, bearing fruit the second year. Very little pruning will be necessary, except cut away crossing limbs and heading back straggling branches.

Varieties.—The most successful varieties to grow depends somewhat on the climatic conditions. In Western Oregon Fay's Prolific, Cherry, Red and White Dutch and White Grape are preferred.

For currant worm hellibore is generally used, but dusting with old air-slacked lime, in which some sulphur has been mixed, has been found quite beneficial, if used at the proper times.

THE GOOSEBERRY.

The growing of the gooseberry has been much neglected and not received the attention it deserves, possibly on account of so many varieties being subject to mildew. In Germany and France no small fruit receives more attention nor so extensively grown, for they are certainly a healthy, aromatic fruit when fully ripe. Gooseberries require a rich, deep, partially moist soil, and as they are gross feeders, must be supplied either with well-rotted barnyard manure or commercial fertilizer. I prefer growing them in tree form and apply the same methods in propagating, planting and otherwise care for them as the currant.

Varieties.—The best success I had and found most prolific and so far free from mildew are the Industry, Oregon Champion and Corliss all very fine and fruit large.

THE BLACKBERRY.

The neglect of growing blackberries is no doubt due to the fact that the wild blackberry grows so prolific and sweet all over our state. And yet there is no finer berry for table use than the cultivated varieties, nor a berry that is capable of being made more profitable. It ripens later than most of

the small fruits and makes a luscious addition to them. "They are usually considered sour and unfit for table use," says Mr. Wragg, but this is because people buy shriveled berries at the grocer's. Blackberries allowed to stay on the bush until fully developed, well-rounded, deep black, sweet and juicy, with the flavor that is nowhere else found in the vegetable kingdom, and ready to drop into the hand, are hard to beat. This kind does not often find their way to market, but when they do, they are profitable. Blackberries require a deep, rich loam and plenty of moisture, therefore reaching their highest perfection when planted in bottom lands or alongside of creeks. The soil should be plowed very deep and otherwise put in good condition. The plants should be set in rows two feet apart in the row and six feet between rows; posts to be driven at each end of a row, to which a wire is fastened about two and one half feet from the ground, the canes being tied to this wire. To successful culture, the training of the blackberries is very essential. In early June the succulent growth should be headed back to four feet. This will cause the plant to throw out numerous laterals, giving more fruiting surface. When the season is over, all the old canes should be removed and burned. After the first plowing the following spring, clean cultivation and hoeing in the rows, they may be mulched a foot deep and two feet on each side to good advantage.

Varieties.— Early Harvest, Lawton and Kittatinny.

THE RASPBERRY.

Perhaps there is no berry more luscious and delicate than the raspberry, nor one which responds quicker to kind treatment, doing its best in a rich, deep, alluvial loam. Before setting a plantation the ground should be thoroughly and heavily manured and plowed under the year before, so as to allow the manure to rot well. Plow again in the fall and make ready for spring setting in rows five feet apart and two feet in the rows. After planting, drive two stakes at either end and run a wire along on both sides of the canes for support; cultivate thoroughly, allowing no fruit to set the first year; top off to twelve or eighteen inches and cut out all old canes. The following year plow and cultivate thoroughly, then mulch, preferably straw manure or old straw only, to a depth of eight to twelve inches, and otherwise treat the same as blackberries. There is, however, quite a difference of opinion among experienced berry growers as to summer pruning, by pinching off the tops in June and thus allow lateral branches to grow for the berries. I have never followed this plan, but have very good success by simply pruning the bushes to an even height in early spring, say three feet, removing all weak and dead canes so all the strength may go into those remaining.

Varieties.—There are four distinct species of the raspberry, namely, red, yellow, black and purple, ranging in value in the order named, few people caring for the black and even less for the purple. The varieties best suited

to our climate are: Red Antwerp and Cuthbert, known as the queen of the market. Golden Queen for yellow, Gregg and Monmouth Cluster for black and Shaffer's Colossal for purple. Of late years, however, a red berry made its appearance in the markets which is highly spoken of and perhaps I cannot do any better than quote from a bulletin of the Massachusetts experiment station :—

"The Loudon raspberry has been tested over a wide range of country and has proved to possess the most valuable characteristics, which are hardiness of plant, firmness of berry, large size, bright color, vigor of its plants and great productiveness. It is the product of a lifetime of labor and experiments on the part of Mr. G. W. Loudon, the aged hybridist, and is a cross between the hardy Turner red raspberry and the Cuthbert. Loudon is so bright in color as to make the Cuthbert look dim by its side."

LUCRETIA DEWBERRY.

This berry is not well known, and yet a few plants should find space in every home garden, as they are a most delicious berry, and by many considered the queen of its species. Plants can be set in the spring after the new growth comes out of the ground and the young canes are several inches long, and if the soil is properly prepared there will be but little loss of plants. This refers to growers who have the plants on hand and want to enlarge their patch. If the plants are received from nurseries they must be obtained at such time and in such shape as they ship them. Now, as this is a trailing berry and the planter wants to make it pay in money, it will be necessary to use some plan to control the vines, for if left to run on the ground they will become so interwoven that it will be impossible to cultivate them or pick the berries without hunting among the weeds. As to plans of controlling the vines, it doesn't make much difference what mode is used, so it is done. A good plan is to set posts along and at the ends of the rows, then stretch two wires horizontally with the rows, one two feet and the other three feet from the ground. Train the vines to these wires in the spring by tieing them to the wires, leaving the vines of such length as experience will dictate. Then the vines are not in the way of cultivation. The new growth can be trained on the ground in line with the rows to be tied up the following spring. Another great advantage in putting up the vines on some plan is there will be two separate sets of vines — the set growing on the ground and the set on the wires. The old vines can be easily removed and burned. This plan will cost something, but when once done it will last for years. (See cut illustrating the training of the Loganberry).

THE MULBERRY.

I have no personal experience in mulberry growing, only remember, that in my boyhood days there were a number of trees on my father's estate in Germany, grown partly for the fruit and partly for ornament, as the tree grows very symmetrical and makes a valuable addition in groups by

way of landscape gardening. Hence, permit me to quote from a writer well conversant with the fruit. : —

"It used to be a rather uncommon sight to see a mulberry tree set out for fruit, but it is not nearly such a rare sight today. It is strange to note the inquiries continually being made for the Russian mulberry, when a far better one, the Downing's Everbearing, has been before the public for thirty to forty years. There is but one thing said which, if correct, would place the Russian ahead of Downing, and this is that it is hardier and better fitted to the northwestern states. But much of this may be guess work. At any rate, if true, it cuts the Downing out from but a small territory. I have had experience with five sorts here, our native sort, Rubra, Russian, Italian, Japanese and Downing, and I am sure that most persons will agree with me in my preference for Downing. As they have fruited here, the Russian and Japanese are almost identical. The fruit is of good size, not so long as some sorts, and rather thicker, and in color a pinkish white. The Italian exists in two sorts, one with white, the other with black fruit. This is the one commonly used for silk-worm culture. These three, Russian, Italian and Japanese, have sweet-tasting fruit, so much so as to be considered over-sweet for some tastes. Our native sort, Rubra, is well named, as its fruit is of a reddish color. It is quite tart to the taste, even when quite ripe. The Downing resembles it in the shape of its fruit, but in color it is quite black when fully ripe. In quality it is between the others, being neither too sweet nor too sour. A strong point in its favor — perhaps the strongest — is its everbearing quality. In this vicinity it commences to ripen in the latter part of June, and continues until the latter part of August. This sort is said to be a variety of *Multicaulis* but in general appearance it is uncommonly like our native one, Rubra. Probably it could be raised true from seed, though layering is chiefly employed to accomplish it. The other sorts are easily raised from seeds. As the mulberry is one of many trees which do not always produce perfect flowers on every tree, it often happens that seedling plants are not fertile, and a good deal of disappointment results therefrom. This is where another great advantage is held by the Downing, as it is propagated altogether from cuttings or layers, hence there is always a certainty of having a fruiting tree when one of it is set out. Mulberries may be planted either in the spring or in the fall."

THE CRANBERRY.

It is a well-known fact that these berries grow best on our coast line, in bogs made for that purpose. Cranberries are always in demand at remunerative prices. Fine specimens of this berry were exhibited at the exposition this year, from the cranberry marsh of Isaacs and Stearns, Alsea bay, Benton county. Beyond question, there is much land in the district I represent suited to the cultivation of this staple, and the matter invites the serious attention of all.

The prospective, indeed, the almost certainly immense value of cranberry culture to the state of Oregon, can be inferred from what has already been accomplished in the state of Washington in this direction. In an article on the subject published in a recent issue of the Seattle (Washington) Telegraph it is stated that C. H. Chabot, of Pacific county, shipped 1,300 barrels of cranberries, which paid him from $8 to $10 per barrel, and netted him the handsome sum of $11,700. The Telegraph adds: "There are men in Washington state who are quietly growing rich in the cranberry business." The same facilities for cranberry culture which exist in that state are found in this. On the principle that it is better to keep money at home than send it abroad, Oregon fruit-growers ought to put on their thinking caps and take the subject into serious consideration.

As to the manner of planting, varieties and other necessary data, allow me to quote from the Northwest Horticulturis:t—

"*How the plantations are made.*—It is generally considered that the first requisite is level land, with view to flooding it with water, and that an adequate supply of fresh water be at hand on a higher level which can be used for this purpose. The land is first dug over and all roots dug out, with view to subduing all vegetable growth which will interfere with the growth of the cranberry plants; after which the ground is smoothed perfectly level, and then it is sanded to the depth of four or five inches. The plants are set sixteen inches apart each way; under such conditions they grow somewhat slowly. This seems necessary to secure the best results. A strong, rapid growth means rank vines and little fruit. The object of the sand is to more effectually smother all other growth than the cranberry vines in the bog, and to induce such growth as will give the largest crop of berries. The bogs so treated do not reach full bearing until the fifth year, though there is quite a little crop borne the second year and more each succeeding one. The expense of establishing such a bog is reckoned at about $500 per acre, and bogs that are well established will last for twenty-five years and longer. Constant attention is required to keep the vines free from other growth until the vines cover the ground, and hand-weeding after the first year is all that can be resorted to. The seeds of the forest trees and shrubs are quite troublesome—such as willow, alder, buckbush, of which there are many seedlings, also red sorrel and velvet grass—and all such growth have to be hand-picked.

"*Varieties cultivated.*—The varieties grown are Early Black, Late Dark Red, Cape Cod Beauty, Chitman Bugle and the McFarland. Plants are furnished for all these varieties except the last two named, of which there is not as yet sufficient stock. The usual price for plants among growers is $3 per barrel, and four to five barrels of plants are required to set an acre.

"After the bog is once established the work is chiefly of a light character, which may be done by a small family, and an acre or two of such in full bearing would afford a more reliable income than any other fruit proposi-

tion of like magnitude I am acquainted with. Anyone having suitable ground on which to establish a bog could easily commence in a small way, with a few rods square, and gradually increase as found profitable to do so.

"*Sanding.*—An important point in the establishment of a bog is the selection, or convenient situation, of sand suitable for covering the ground; this should be coarse, of a porous nature, which will let the water through readily; if it contains some gravel, all the better; but it should contain no soil. The bogs of the Pacific Company are under some disadvantage in this respect, as the sand is so fine that it packs and the water stands on the plants; at times it is undesirable for it to do so. The most considerable enemy the cranberry grower has is the cranberry worm, the method of destroying which is to flood the bog when they appear. On the old bogs, when the ground had not been properly leveled, such parts as could not be covered with water were often bare, having been destroyed by the worms.

"*Without flooding.*—Mr. B. A. Landers, who has a small bog adjacent to the Pacific Company's and was formerly manager of it, having been sent from Cape Cod, Massachusetts, to fill the position, has started into business without the usual supply of water, and says he does not think it absolutely necessary; that he has seen much harm done with excessive flooding at times when the plants were in bloom by preventing the setting of the fruit. At any rate, he has not been deterred from entering upon the business through lack of water to flood his bog at will, as the Pacific Company are able to do. There seems to be no reason why a spraying with a paris green solution of one pound to 200 gallons of water would not effectually destroy the cranberry worm and possibly secure larger crops at much less expense than by flooding the bogs. As this difficulty occurs in May and June, at a time when the plants are in bloom, no possible harm could come to the fruit through treating with this spray."

It seems to me that spraying with the arsenite of soda solution, or possibly spray number 14, as given among our sprays, would prove more beneficial than paris green; however, it should be borne in mind that no tree or berry plant should be sprayed while in bloom, as it seriously hinders perfect pollination.

ONE OF CLATSOP COUNTY'S NEGLECTTED RESOURCES.

Within five miles of Astoria are natural cranberry bogs from which the farmers have gathered wild cranberries since the first white settlement in Oregon, and from which the Indians have gathered the berries for unknown centuries. More than 1,000 acres of this native cranberry bog lie between the sand dunes and the clay land of Clatsop plains. The adjacent farmers, occupied with stock-raising and dairying, have scarcely given a thought to the cultivation of the cranberry; yet on the bogs of this coast the cultivated and eastern berry does well. In Coos, Lincoln and Tillamook counties many bushels of the finest berries are now produced and marketed at remunerative prices.

Enough has been done in these localities in the cultivation of the cranberry to dispel all doubt about its success, and to afford the necessary experience. The industry is of enough importance to be considered at the meetings of the berry growers of the state, and should be brought before them and the public. As many as 1,000 bushels to the acre have been grown upon some of the lands referred to, and the cranberries sold this year at $2.50 per bushel.

The Ladies' Home Journal of November reports that a field of 50 acres at Cape Cod yielded this year 8,000 barrels, or 20,000 bushels of berries. But it is estimated that on the Oregon coast 200 bushels to the acre is an average yield for the whole land under cultivation. Figure this at only $2 per bushel, and the gross receipts would be $400 per acre, and $400,000 per year for the possible product of Clatsop county.

THE STRAWBERRY.

Now that the time for planting strawberries is at hand, many inquiries come, notably from newcomers: "Which are the best varieties to plant, especially such as are self-fertile?" An easy question to ask, but a very difficult one to answer. As in all her creations, however, nature has made her choicest feminine; that is, the blossoms of the finest varieties are pistilates (female), and must be planted alongside some staminate (male) variety in order to bear fruit. In order to show how difficult it is to recommend any given variety, I will quote from Bulletin No. 79, Cornell university experiment station, New York. Professor Bailey sent out questions to be answered to over one hundred commercial strawberry growers in different parts of the state, but I will give only the six varieties receiving the highest vote:—

Best home berry.—Bubach, 12 votes; Crescent, 12; Jessie, 9; Wilson, 9; Sharpless, 8; Warfield, 8.

Most productive variety.—Crescent, 24 votes; Wilson, 15; Warfield, 14; Haverland, 11; Parker Earle, 11.

The best shipper.—Wilson, 29 votes; Parker Earle, 10; Warfield, 5; Burt, 5.

The earliest variety.—Michel, 39 votes; Crescent, 18; Wilson, 12; Bubach, 6; Beder Wood, 4; Warfield, 3.

The latest variety.—Parker Earle, 32 votes; Gandy, 16; Burt, 5; Bidwell, 2; Jessie, 2.

Best all-around berry.—Wilson, 20 votes; Crescent, 16; Bubach, 10; Haverland, 10; Warfield, 10; Parker Earle, 7.

And further says: "The most striking feature of these replies is the various character of them. Here are fifty-two varieties recommended for one or another purpose by one hundred and ten persons, and there are scarcely two persons in the list who recommended the same varieties for the various uses. It will thus be seen that evidently climatic conditions, even over a small area of country, and differences of soil, have a marked effect."

The six most popular varieties, according to these votes, are: Wilson, Crescent, Parker Earle, Warfield, Bubach and Michel.

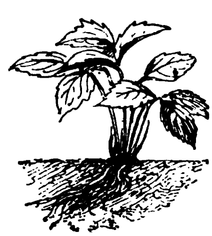
With us in Western Oregon we would probably find upon a vote that the Wilson stands at the head, closely followed by the Sharpless, Jessie, Captain Jack or Big Bob for staminate varieties, and Bubach, Haverland and Crescent for pistilates. In Eastern Oregon Clarke's Seedling is the shipping berry and is grown almost exclusively for that purpose, but not a good berry for home consumption with those named above, while Triumph d'Agen is considered the best shipping berry with us, but this field is disputed by a new seedling, the Magoon, which is certainly a very promising berry. I have fruited this berry now two years on my grounds, alongside of Big Bob, Wilson, Parker Earle, Clark's Seedling and many others, and am ready to bear testimony that it is the best berry I have, with the additional advantage of a long range of season, extending over six weeks. It is common to see blossoms and berries in all stages of ripeness on the same stool.

In planting pistilate varieties, such as Bubach, Windsor, Crescent or Haverland, the planter must keep in mind what kind of a berry he desires to grow, as they are more or less affected by the variety which furnishes the pollen for fructification. If a juicy, sweet and round berry is desired, plant with Wilson; and if a larger subacid berry is desired, plant with Sharpless or Big Bob, always two rows of pistilates to one of staminates.

However, I would advise intending planters to inquire of their neighbors which variety they succeeded best with, and plant those, but by way of experimenting would plant such others as are here given.

Strawberries do well in most soils, but the preponderance is for a sandy loam and should be planted in rows three feet apart and eighteen inches apart in the rows, so thorough cultivation can be given, as weeds and straw-

TOO HIGH.



SET IN A HURRY.

GOOD.

berries do not agree very well; they should be liberally fertilized with bone-meal, nitrate of soda and potash, to obtain best results. Barnyard manure is not desirable, as it makes too much foliage and few berries.

SOMETHING NEW ABOUT STRAWBERRIES.

Barrel culture of strawberries is a new departure in producing that delicious fruit. Anything practicable which facilitates raising it more generally is worthy of consideration. No fruit is more widely distributed or has a more extended habitat than the *Fragaria* family of plants. The strawberry grows nearly everywhere on the globe where anything in the vegetable kingdom will grow. It is found under the equator at friendly altitudes and also near the Arctic circle. While it is one of the most excellent, palatable and healthful in the entire catalogue of fruits, at the same time it is one of the most easily propagated and grown.

Rich and poor, the peer and the peasant alike, may possess and enjoy this fragrant and palatable fruit. W. H. Jenkins tells in the Country Gentleman of a recent date how every home may raise its own berries. This may seem a startling proposition, but he says "many people living in villages and cities, who have no land for a garden, would appreciate having a strawberry bed of their own, so that they could pick fresh berries at any time for the table, which would be of a better quality than those usually offered in the market." The idea is so novel that it will strike many persons as visionary, but Mr. Jenkins says it has been tried and proved successful.

The method employed is described in detail, and so plainly that an amateur or novice can follow the instructions and succeed in the undertaking.

Any strongly bound barrel will do, but a linseed oil barrel is preferable. If a kerosene barrel is used it should be burned out before using, otherwise it may impart a disagreeable taste to the fruit. The entire outside of the barrel is laid off in four-inch squares, like a checkerboard. Then begin at the bottom and bore a row of inch holes around the barrel eight inches apart, horizontally. In this way bore five rows of holes, eight inches apart, or in alternate rows of the squares, boring the second row of holes from the bottom on the perpendicular lines instead of in the squares, and so on alternately to the top. Five rows of holes, with twenty-seven in a row, will give one hundred and thirty-five plants. Place soil in the barrel level with the first row of holes, using rich garden soil with a little well-rotted stable manure thoroughly mixed in it.

The next step is to begin inserting the strawberry plants through the lower row of holes. Any variety desired may be used, of bedded plants, selecting, as in garden culture, the pistillates and bisexuals. Mr. Jenkins speaks of the Sharpless with a small mixture of Crescents as growing very large berries when grown in this way; also of the Bubach and Marshall, and adds that for quality of fruit he has found none better than the Cumberland Triumph and the old Charles Downing. These two varieties are bisexual and need no others to fertilize them.

The plants are inserted through the holes, and the roots are placed a little higher than the stems, so that in settling there will be no strain or pres-

sure on the latter. As in setting plants in open ground, the roots should be spread apart, the soil pressed firmly about them, and water sprinkled over them. The process is repeated until the barrel is filled, and then covered to prevent the escape of moisture. The subsequent management is easy. No runners from plants appear, no weeding or hoeing is required, and the strength of the plant goes to the production of fruit. The berries are kept clean, and if the barrel is set on a box or other elevation, they will be free from many insects. There is no fear of failure from drought, as the ease with which moisture may be supplied removes all doubt on that score. Care should be exercised in watering, however, in order that the soil may not become too wet, and to avoid this it is recommended that a few holes be made in the soil down through the barrel with a stick, and that water or liquid manure be poured down as the plants may require.

The correspondent of our excellent contemporary, the Country Gentleman, says that a nurseryman within his knowledge in the east had been selling barrels furnished in this manner with plants for several years past, having sold more than a thousand to people in the state of New York, many of them in Brooklyn, and he has no doubt of the success of the plan.

As to time of planting, it may be done either in spring or fall. Planted in August or September, a fair crop may be expected the following year, and the vines will bear for four or five years without renewal. A maximum crop is five bushels from a barrel, with three or four as the average, depending, of course, on the management and varieties of berries.

There is an æsthetic side to this method of strawberry culture. The ornamental feature of it will hardly be overlooked. A barrel completely covered with green foliage is of itself an object of beauty, and when the plants are in bloom it becomes still more beautiful, especially on a lawn. And later on, when loaded with trusses of luscious berries, it becomes a still more interesting object.

In brief, these are the essential features in this new departure of the barrel culture of strawberries. There are other considerations suggested by the contributor mentioned, and still others which will suggest themselves probably to the reader relative to the development of this method, from a commercial point of view. But these matters do not come within the scope or purpose of this article. Our object is accomplished in presenting a novel method of growing one of the most justly popular and delicious fruits by people living in town or hamlet, as well as in the country.

THE LOGANBERRY.

This is the berry that has been spoken of as the raspberry-blackberry, on account of having characteristics of both these fine berries. It is supposed to be a hybrid between a variety of the European raspberry and a variety of the wild blackberry of the Pacific coast. The approved method of pro-

pagating the Loganberry is by stolons, yet the plants may be grown from hard-wood cuttings.

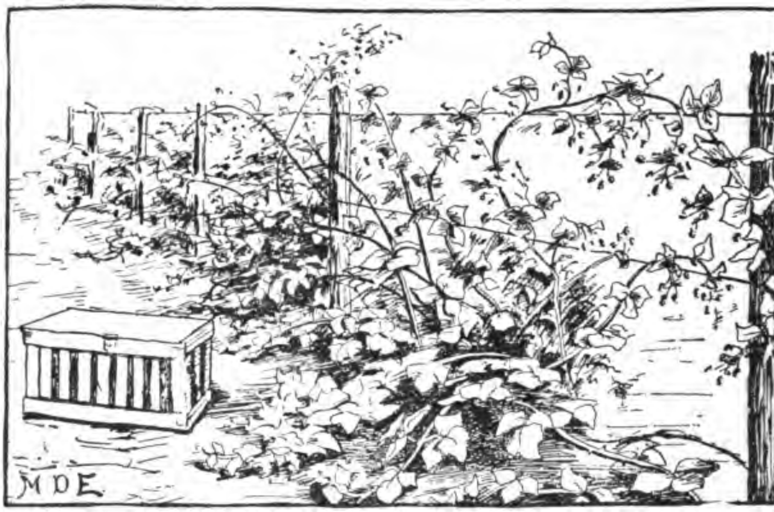


PLATE I.

This plate shows how to build trellis for the support of the canes of this as well as of the Lucretia dewberry. Plate II shows the fruits in all stages of ripeness, even to the blossoms, which shows a long-producing season. The fruits grown in Oregon, however, are very much larger than shown in the plate. This berry is not as well propagated as it deserves, though one of the best berries grown today. A plant which was sent to me by a friend has proven and done finely, producing most delicious fruit. Perhaps I cannot do any better than to give Judge J. H. Logan's — the originator — own description as to the

HISTORY OF THE ORIGINAL LOGANBERRY BUSH.

Your letter of inquiry in relation to the Loganberry is at hand, and in answer thereto I will say that prior to 1880, taking great interest in small fruits, particularly the blackberry and raspberry, I had tried in my garden every variety of those berries that I could obtain. Among them were the Texas Early, a high-bush, *Rubus villosus;* the Aughinbaugh, a pistillate dew-berry, and an old variety of red raspberry which had been cultivated here for many years, name unknown but resembling the Red Antwerp. The Texas Early is sometimes called Crandall's Early, because brought to this state by Dr. Crandall, of Auburn. I was not satisfied with any of these fruits as a table berry. The wild *Rubus ursinus*, of which the Aughinbaugh was the best variety obtainable, bore a fruit that was all that could be desired in flavor, but all of the *Rubus ursinus* type are weak growers and poor bearers, so much so that they are unprofitable for general cultivation. The Aughinbaugh being pistillate or uni-sexual, I deemed it possible to grow a cross between it and some

other early blackberry, such as the Texas. I did not then think it possible to cross the *Rubus ursinus* with the Lawton, Kittatinny, or any other *Rubus villosus*, for the reason that the latter flower after the *ursinus*, and repeated trials of such a cross since that time have been failures with me. I had by the merest accident planted the Texas on one side of the Aughinbaugh, and the red raspberry heretofore spoken of on the other. The canes of all three intermingled and flowered and fruited together. For the purpose of securing an intermediate form between the Aughinbaugh and the Texas, I gathered and planted the seed of the former in August, 1881, expecting a cross between those two blackberries. A cross between the blackberry and raspberry was not then intended or even deemed possible by me.

I raised about fifty of these seedling plants. During the next season, 1882, I saw from the growth of the canes that the cross had produced something heretofore unknown. The canes of all except one were unlike anything I had ever seen before that time. The exception was a plant very similar in every respect to the Aughinbaugh parent, but very much larger and of stronger growth. This was the Loganberry. In the spring of 1883 I set the gardener to cultivate these plants. In doing so, by an unfortunate accident the Loganberry plant barely escaped extinction. When he got through with it there were but two or three buds left to fruit that year. The last of May, 1883, the fruit ripened, and then for the first time the extent of the creation was noticed. It has been repeatedly stated in public prints that I entertained the idea when I planted those seeds of a cross between the raspberry and blackberry. I am sorry to disturb one of the supposed truths of history, but candor compels me to say that such is not the case. I did not then deem such a cross possible, and did not know what I had done until May, 1883, when the plant first fruited.

Subsequent observations of the Loganberry have confirmed me in the belief that it is entirely unique and distinct as a fruit. It is as much a new and individual creation of the *Rubus* family as the blackberry or raspberry. Repeated plantings of the seed since that time have confirmed this individuality. Out of thousands grown from seeds not one has to my knowledge ever shown any of the distinct characteristics of either parent, not one has gone back to the original type of either the red raspberry or the Aughinbaugh blackberry. Most of the seedlings, to be sure, are inferior to the original, perhaps one in one hundred only has any merit whatever, but they are all, like the Loganberry, essentially a red blackberry, but similar in form of cane, leaf, time of ripening and sex of flowers to the original Loganberry. All my efforts, too, in the direction of crossing the Loganberry with either of its parents, or with the other seedling crosses between the Aughinbaugh and the Texas, have so far been failures.

The characteristics of the Loganberry as to shape and conformation of fruit and the canes and roots are essentially those of the Aughinbaugh. Unlike the raspberry parent they have no adventitious rootbuds, being propagated entirely by growth from the tips of the canes like the Black Cap raspberry. The fruiting canes are replenished each year by shoots from the crowns, which fruit and die yearly like all others of the *Rubus* family. The core remains with the fruit like the blackberry. Its principal similarity to the raspberry is in the color and the flavor, although the blackberry dominates in flavor as well as in all other characteristics except color. As to the fact of the plant being a hybrid between the blackberry and raspberry, of course there is no absolute proof. The color, with the distinct raspberry flavor of

the fruit, and the circumstances under which it originated, I think render the fact of such a cross almost certain. Since then, too, the possibility of a cross between the raspberry and blackberry has been demonstrated beyond a doubt. At the same time as the origination of the Loganberry, and from the seeds planted with the seed that produced that fruit, another creation was produced in the *Rubus* family of very great interest. I have stated that from the seeds planted in 1881 about fifty plants came, of which the Loganberry was only one. These plants were crosses between the highbrush Texas and the Aughinbaugh dewberry, and are in the blackberry family just as unique as the Loganberry. Most of the characteristics of this new blackberry are from the mother, the Aughinbaugh. Like the Loganberry, it has no adventitious rootbuds, but propagates from the tips only, the same as the Aughinbaugh and the Logan. The berry is very long; specimens have been found two and one-quarter inches, shining black, with the flavor of the *Rubus ursinus*. The canes are peculiar. They are covered with small spines, thickly interspersed and not very strong. The canes sometimes are one and one quarter inches in diameter and start up in the spring like the highbrush, but when they get four or five feet high they start off with a trailing habit and sometimes grow over thirty feet long, and towards fall the tips seek the ground and root. One of the great characteristics of all these fruits is the fact that they ripen very early, generally beginning in this climate in the middle of May, six or eight weeks earlier than the earliest of the high-bush varieties. As to the adaptability of these berries to the different climates, I am not able definitely to say. The university of California has experiment stations in all altitudes in this state—high, low, hot, dry and moist. At all of these stations they have the Loganberry, and the reports from all are that the berry is doing well. As I have before stated, the Loganberry is reproduced from seed, and while such seedlings are essentially Loganberries, not one in one thousand is equal to the original. Such seedlings are rank frauds when sent out as the Loganberry and unprincipled nurserymen in this state having in view only a little temporary advantage have been flooding the east with such seedlings, and wherever sent the result has been condemnation of the Loganberry. It is like testing the merits of the Bellefleur apple by trees raised from its seed. That my statements herein may not be misunderstood, I wish to say that I have no pecuniary interest in the propagation or sale of this or any other plant or fruit, the control of it having long since passed out of my hands.

I send you today a photograph of the Loganberry fruit, grown in the open air in this city, January, 1897,— the picture having been taken January 8, 1897. I do not send this to show that the fruit has any commercial value for the purpose of growing in winter, but more for the purpose of showing the mildness of our climate where this fruit originated. The bulk of the fruiting of this plant is in May, June and July. However, the fall crop is often of considerable importance.

Mr. M. A. Thayer, says:—

WHO SHOULD GROW BERRIES.

"First of all, farmers everywhere, for family use. Farmers must grow berries or do without. No one can grow them so cheaply as he. He gets them at first cost, fresh from the vines, and to the extent of his own family,

has the best market in the world — a home market. He can select the best land location on his own farm, and is sure of a profit with half a crop.

"Farmers can never have ideal homes without the fruit garden. It teaches the lessons of intensified farming, and results in better tillage, larger crops, better stock and improved methods in every way. Good gardens and poor farms never keep company long. The growing of berries for family use is easily done. The growing of berries largely and selling them in good market requires considerable skill and a special business tact. Only those who have good location, good market and a taste for the business should attempt it. Many small farmers so situated are making a success by commencing moderately and increasing acreage from season to season as experience warrants. Berries should be grown by owners of all village homes, and acreage property in city and village may be profitably used for that purpose.

"The business or professional man, almost broken with care, may recover health and strength in the pleasant walk of horticulture. It is restful to both mind and body. Many women dependent on their own efforts are securing substantial aid from their garden; berries and flowers thrive best under the gentle touch of women. Many a bright boy may receive his first incentive to business and earn his first money by growing berries or vegetables. Give them a patch of ground and encourage them in this work. The amateur growing berries for pleasure also gets close to the heart of nature and in common with every worker of the soil may receive her smile."

WHAT TO DO WITH THE POOR FRUIT.

By S. P. Sanders.

It is much easier to answer what we should not do with poor fruit than to say what we should do with it. We should not gather, grade, pit and dry, box and sack, haul and pay freight on it to a distant market, then to have it sold at a price which returns nothing to the grower, while it establishes a low price and hinders the sale as long as it lasts of the better grades of fruit. Small buyers and consumers of prunes do not stop to consider the relative economical values of large and small prunes, but snap at the ones that are sold for the fewest cents per pound. They prefer to buy two pounds of 150's, consisting mostly of skin and pit, at three cents per pound, to one pound of 50's, mostly pulp, at six cents per pound. They say a prune is a prune anyway, and cents are cents. They are too smart to be victimized by the grocer who offers them prunes at six cents, when they can go across the street and buy prunes for three cents per pound. Poor, deluded creatures! There is no one to save them from their folly. They buy and eat 150's, and then complain that California prunes are "not what they are cracked up to be." They cease buying and using them.

How small prunes act.—We consign this miserable stuff early, so the corner grocer can stock up for the holiday trade, while we sit around and whine because there is neither sale nor price for our prunes. There is a way to improve the price — that is, to make them scarce. To make prunes scarce while there is a constant increase in production, we must find a new and different use for part of them. The increase in consumption of prunes has not kept pace with the increase of production or of population for the last decade. Instead, there has been an actual falling off, for 60,000,000 pounds is estimated to be the average consumption in America annually for the last few years, while there has been an increase of more than 10,000,000 of population. The thing that most concerns us in the matter is that whereas France and Turkey formerly supplied the 60,000,000 pounds, we now supply them in their stead.

What to do with a surplus.— Since we have arrived at the point where there is an overproduction of prunes, and since there is going on a steady increase of production, it behooves us to seek an outlet for the superabundance. Let us consider the surplus a waste, and seek to convert it into some useful form as a by-product of the orchard farm. The cotton planter ceased

to grow rich and his land became impoverished under successive croppings so long as he sent to market only his lint, while he burned or threw into the river his cotton seed to get rid of it. But he began to thrive again when he returned the seed to the land as fertilizer. Soon he discovered that the seed was too precious to use for fertilizer—he could better put money in his land in some other form. So he fed the seedmeal to his stock, after he had pressed from it the oil, which he mixed with tallow, called it cottolene and gave the world for cooking purposes a valuable substitute for lard. Better still, he sent his cotton seed oil to Europe, where it is transmuted into olive oil and goes masquerading under a pretty French label back to America and throughout the civilized world. Cotton growing pays now; the by-products pay as much as the staple. Petroleum furnishes another familiar example of valuable by-products. The original idea was to produce from the crude petroleum an illuminating oil, but out of it have grown the manufacture and adaptation to use of some scores of products, among them gasoline, naptha, benzine, illuminating gas, lubricating oils, paraffine wax, dyes, and numerous other substances too tedious to mention, of commercial value. In the great manufactories, not a paring of leather from the shoemaker's bench nor a shaving from the machinist's lathe but is converted into something useful or beautiful.

Prunes as animal food.—Casting about for some valuable by-product of the orchard, we find that inferior fruits may be left upon the ground when they fall to enrich the soil. Kind and provident old mother nature will rehash them and serve them up again in better style sometime. It is better, however, to pass them through the animal economy. The excreta of the animal will be equally valuable as fertilizer, while the growth of the animal increases the food supply of man. Dried prunes, apricots, peaches, figs and grapes show from three fourths to fully equal food values with corn, oats, barley, wheat and wheat bran. I would not advocate buying hogs by the carload and prunes by the ton with which to fatten them, but about every orchard in which a home is maintained food material enough goes to waste in stale milk, table scraps, parings of vegetables, etc., to make along with a little inferior dried fruit, a daily ration for one or two pigs upon which they will thrive and grow from weaning age till they are ready for the butcher. The fruit being cured may be fed out quickly or slowly, according to conditions—that is, much fruit, many pigs, little fruit, few pigs, but none need go to waste; all may be converted into available form which your meat man will be glad to take in exchange for his service from his wagon.

Prune-fed pork.—Perhaps you do not eat pork, and have scruples against producing it, but there are others who love it, and you would have the satisfaction of knowing that you furnish your pork-eating neighbors with a fine article of prune-fed meat, which is the best there is made. There is no great speculation in it, but a pair of pigs, with a little patch of alfalfa,

milk, scraps and fruit unfit for market, will quickly grow into a $20 gold piece to apply on your meat bill. If I intended to embark in an enterprise of growing prunes for fattening hogs, I would weigh and measure everything used and keep accounts of outgo and income; but I scorn statistics, and would expect my pig to resent having his prunes weighed out and charged up to him against the day when he would adorn the shambles and pay me back in lard and spareribs. There is no speculation in disposing of inferior fruit in this way; it is one of the small economics which we should not despise and which every orchardist may practice with two-fold benefit. We enhance the value of good fruit by making it scarce, and ultimately get a better return from our culls than we could by selling them in the market as fruit.

Fruit brandy.—There is yet another use for inferior fruit by which it may be converted into an article of commercial value. It may be distilled, and brandy is the result. Our moral sensibilities may be shocked at the proposition to convert good, honest hog feed into brandy, which sometimes makes beasts of men. I mention it as a possible means of avoiding the mischievous effects of sending inferior fruit to distant markets. The intelligent orchardist will strive to produce only superior fruit. To this end he will cultivate, irrigate and fertilize the soil, prune the tree and thin the fruit; but after all his efforts there will be some misshapen culls, some diabrotica or bird-eaten, some prematurely ripened, some from unthrifty trees, some that hang late and will not ripen sweet; whatever the cause may be of its inferiority, let us refrain from sending it to market as fruit.

APPLE STOCKS RESISTANT TO PESTS.

By B. M. Lelong.

The "woolly aphis," so called, is well known to most every grower of apples and is the most troublesome pest affecting that tree. All remedies, however effectual, have given only temporary relief. In Australia, so deadly had the attacks of this insect been to apple orchards that apple culture was almost entirely abandoned, until the discovery of aphis resistant stocks. It was discovered that the Northern Spy on its own roots was absolutely aphis proof. Other varieties, such as the Winter Majetin, Gravenstein, Duchess of Oldenburg, New England, Pigeon, Striped Beaufin, Perfection, Lord Woolsey and Irish Peach, were also found to be aphis proof, but the Northern Spy is the most preferable. In this state Rawle's Janet and Golden Russet have been known to somewhat resist the attacks of the aphis, but are not absolutely aphis proof. There are three methods of growing aphis resistant stocks in Australia:—

A starter.—Side-graft a piece of any kind of apple-root in an oblique cut on a cutting two inches from its base. The cuttings emit roots of their own below the inserted root; the following winter the plants are lifted and the piece of root that was grafted on is cut clean out, leaving, of course, the young plants now on their own roots.

Root cuttings.—Another method pursued is to propagate the species by their own roots as root cuttings; in planting the roots, leave the smallest trace only above the surface. These root cuttings make fine trees, and are fit to regraft the following season. Northern Spy scions are also grafted on their own roots; likewise Northern Spy and Majetic scions are also worked on Northern Spy on Majetin roots. It seems to make but little difference either way; they are blight-proof stocks, and all varieties worked on them do well.

Root grafting.—This differs but little from the first method. The young apple seedlings are taken up in January or February, the roots washed of all dirt, etc., and cut into lengths of about 4 inches. There are various ways of uniting the root and scion, but the whip-and-tongue graft are the most preferable. The scions and roots being prepared are united to the root as follows: An oblique or sloping cut or tongue is made in the root, and the scion is likewise prepared, which is made from 4 to 10 inches long, and united with the root, leaving to it a projection from 1 to 10 inches long be-

low the point of the union. As each graft is made it is tightly bound with strips of calico or cotton cloth to keep the parts in place, or can be wrapped with strips of waxed paper. These decay shortly after the planting of the graft. The secret of success is the same as in all grafting; the inner bark of the scion and root must be in close contact at one or more points. The union only takes place where these parts are associated. The grafts are then put away until planting time in February in the following manner: On the floor of the propagating house, or shed, sand is spread out at a sufficient depth to cover the grafts. The grafts are stood up or laid down at an angle of 45 degrees, in bunches or loose, and covered with sand to within an inch or two of the top. They are kept in the sand until the scion and root callous over; they are then taken out of the sand and planted in the nursery. While they are in the sand care must be exercised that they be not too wet, as the bark of the grafts is liable to decay; again they must not be allowed to get dry, as the bark of the graft will shrivel and adhesion is prevented. In the spring the grafts start; all shoots are removed except one, the most vigorous of all, which is to form the tree. In a year the young tree, entirely aphis proof, is ready to be planted to orchard, or, if other varieties are wanted, they are budded over or grafted.

RESISTANT APPLE ROOT.

By Prof. E. J. Wickson.

Australian horticulturists are entitled to credit for demonstrating that the woolly aphis can be circumvented by propagating trees upon roots which are proof against injury by this insect. In their nursery practice they select such roots, and manifest surprise that Americans are still looking for insecticides when the pest can be avoided. The roots of several varieties have shown degrees of resistance in Australia, and from these selection has been made. The roots of the Northern Spy are, on the whole, the best, but it has been shown that the roots of seedlings grown from Northern Spy seed vary somewhat in degree of resistance. In order to promote local trial in this state, we offer for distribution pieces of roots of trees imported from Australia and represented to be their best, selected Northern Spy stock. These pieces are intended for use in root grafting by those who apply for them, and to be planted as "mother trees" to furnish subsequent supplies of roots for larger propagation.

Root grafts are made by using scions about six inches in length of wood of the last year's growth. The tongue graft is usually the best for this purpose. To secure a resistant tree a Northern Spy scion should be used, for then if roots start out from the bottom of the scion they, too, will be resistant. Some other variety can afterwards be budded into the growth from the scion a little above the surface of the ground, and then with no danger of rooting from this variety the tree remains resistant. The roots we send have a square cut at the top of the root piece, and at this end, of course, the scion should be inserted. Wax is not necessary in root grafting if a good fit is made and the root graft is not allowed to dry out. The grafts should be made as soon as the root pieces are received, and kept in moist sand until the ground is in good condition for planting out ordinary fruit trees. It is possible that many of the pieces we send can be used as root cutting, if one knows how to handle them, but the root graft is much more likely to succeed. The root pieces will be sent in small bundles, one to each applicant, at 10 cents per package, by mail.

A VOICE FROM AN OLD ORCHARD.

By HATTIE GEORGE.

In order to awaken an interest in horticulture among the youths of our state, Mr. Henry E. Dosch offered a gold medal for the best composition on fruit-growing. The following is the essay that was awarded the "Dosch medal" for best composition. Judges: Dr. J. R. Cardwell, Prof. E. R. Lake and Mr. Frank Lee:—

"We are among the pioneers of this country, for we were planted in 1856, and I can look back to those years of long ago, when we were the pride of this country, and our ripening fruit was a golden harvest for our master, for he sent us off to the mines or to the ships that came into the harbor. Our master was a lover of the gun. He spent a large portion of his time in hunting and fishing, so not much attention was given to our cultivation, but still we were determined to help keep up the reputation of the state for its red apples and juicy pears, until about fifteen years ago we first noticed the codlin moth, and the next fall our apples were wormy, and as years went on, we noticed our branches were afflicted with fungous diseases, and when we had cold, damp weather in the spring, our leaves had a gray appearance, caused by the powdery spores which projected through the epidermis of the leaf, and they would soon dry and drop. And as we looked around us more closely, we found apple canker and scab. On Baldwin apples we noticed that a fungous began its work when the fruit was nearly ripe, and continued after the crop was harvested. This was the bitter rot.

"We felt that we were growing old and useless, for our master abused us, telling us that we were of no account; that our fruit was only fit for pig feed. But, three years last spring, there came a stranger, looked over the place, and bought. He brought his hands to us one morning and said: 'Boys, there is so much to do, we will do what we can this year and finish next. But, thank fortune, I don't find any scale here.' They grubbed all

half-dead, and all the trees that were not of good bearing or selling qualities. They then trimmed all our out-spreading branches and the tangle of limbs that grew between the branches; then they scraped all the rough bark and moss off, which they said was good hiding places for insects and their eggs. Then they took some crude carbolic acid and mixed with whitewash and washed our bodies as a preventive against borers and the eggs of insects. All the rubbish was raked together and burned and then they thoroughly cultivated the ground. They left us and we thought our troubles were over, and as the sunshine dwelt upon us we began to bring forth beautiful fruit and our leaves sang with the wind.

"Our new master came one day and we looked and saw him mix 45 gallons of water, 4 pounds of copper sulphate and 6 pounds of lime. This he threw over us with a spray pump. He told us not to be afraid, that it was for our good, for he had found that we were much afflicted, and this would have to be repeated again and again to keep all diseases in check and prevent other diseases from attacking us. Sometimes he would use this mixture, then some other kind, and sometimes we would hold our breath, for the smell would overcome us. We thought he was going to replant those trees he had grubbed up, but he said: 'No, never! For the ground has certain resources in the soil that has been consumed, and to plant young trees there will be throwing money away. We will grub out this hazel patch to your right and plant it in young trees, and you can supply me in fruit till it begins to bear.' And today we hold our heads high and reveal to the gaze of all, beautiful leaves, healthy trunks and excellent fruit, which is not of a large quantity this year but the quality will bring some return to our master for the attention he has given us, and we will yet live to see his fine young orchard to our right bear many crops before we are condemned as useless."

OUR CONIFERS ECONOMICALLY CONSIDERED.

By Dr. J. R. Cardwell.

Oregon has her snow-capped peaks, deep cañons, far extending glacial fields, magnificent waterfalls, Coast, Cascade and Blue Mountain ranges of wildest and ever-varying scenery; the far-reaching, undulating plains of Eastern Oregon; the rich, broad and incomparably beautiful valleys of the Willamette, Umpqua and Rogue rivers; the lordly Columbia — the second river on the continent — with a wealth of scenic grandeur along its banks that has to the traveler rendered the famed Hudson tame and spiritless; the Klamath lake country reaches to the horizon in one level plain of luxuriant, perennial grasses; Crater lake and surrounding national park are destined to be wonders of the world, and there is much more that is grand, beautiful and impressive in Oregon scenery, yet no one feature of our state can claim more, nor is destined to attract more attention or do so much for our material prosperity and pecuniary gain as its phenomenal forest of giant evergreens, cone-bearing trees. Of these, their vast extent, individual characteristics and commercial value little is known to the outside world.

The great equatorial current, Kuro Siwo — Japan current — circling and surging along our coast, giving off a warm, moisture-laden air which, rising into our mountains and passing over our valleys, is constantly precipitated in an invisible form in dews and our annual rainfall. The deep volcanic mountain soil, rich alluvial valleys, and mild, equable climate in which the evergreen grows almost the twelve months in the year, have conspired to develop in Oregon and Washington the grandest and most extensive, as well as the most valuable forests on the continent.

Of the thirteen genera of the order *Coniferæ* in Oregon, thirty-five species have been discovered and named, all of which are new and only found on the Pacific slope.

We have no evergreen trees in Oregon found in the eastern states or elsewhere with possibly the exception of one variety, *Juniperus communis*, common juniper of Eastern Oregon, about which botanists differ. All other varieties are definitely new. Of the leading families we have ten pines, five firs, two spruces, one larch, two cedars, two chamæcyparis, one

arbor vitæ, one cypress and four junipers. The most notable of which I wish to speak specially is a new genus, a new species, a new variety, single and alone, botanically known as *Psudotsuga Douglasii*, as the name indicates, false spruce of Douglass, discovered by a very able and enterprising Scotch botanist, David Douglass, who explored and botanized our forests in 1823. This tree called by us a fir — not a fir; called by some a spruce — not a spruce; extensively known commercially as Oregon pine — not a pine, is in many respects the most remarkable tree in the world, and forms eight tenths of the forest area of the northwest and extends over a larger territory than any other tree on the continent, and so far as I know, in the world, reaching from far up in Alaska down to Mexico, from the Pacific shore to the Rocky mountains. This tree, it may be said, is the glory of our forests and of an economic and commercial importance, scarcely yet comprehended or dreamed of, and is destined to form an important factor in the wealth and development of the state.

So highly is this tree appreciated abroad for its rapid growth and great adaptation to varid soils and climate, its elegance and the superiority of its wood, that through its forestry commissions it is fast becoming the forest tree of Europe. England, France, Germany and Austria now have extensive forests of these trees and are planting annually. Of our timber land nine tenths it is estimated belong to the class *Coniferæ*, and is evergreen, and as stated, largely Douglass false spruce, interspersed with cedar, yellow pine, sugar pine, spruce and fir. These comprise a forest area estimated at seventy-five miles wide and three hundred miles long, containing sixteen thousand square miles of available timber, which, if placed on the market in rough lumber, would bring $4,000,000,000, and would more than pay the national debt. The trees of our forests, owing to the favorable influences referred to, are of rich, dark green foilage, rapid growth to enormous proportions, commonly from 3 to 6 feet in diameter, 350 feet high, sometimes more, and 185 feet to the first limb. This I state from actual measurements from trees prone on the ground. A visiting lumberman from Chicago a few years ago found a stick which squared 6 feet, 160 feet long, which he had placed on three Union Pacific cars and took home as a curio. The vice-president of the Oregon Pacific selected a tree 300 feet high which he took to the world's Columbian exposition intact.

Our most valuable lumber trees are Douglass false spruce, which I shall hereafter speak of, in the language of the lumbermen, as red and yellow fir; *Thuga gigantea* — red cedar; *Pinus ponderosa* — yellow pine; *Pinus Lambertiana* — sugar pine; *Abies Mertensiana* — white spruce; *Chamæcyparis Lawsoniana* — white cedar. Of these there is a large, rapidly increasing commercial export by ship and rail, soon destined to bring to us millions of dollars annually. The superior qualities, distinctive merits, and various uses of these lumbers are matters of interest which cannot be con-

sidered at this time. A brief mention of some of the characteristic features, chief merits and economic values of the red and yellow fir will fill the space allotted to this paper. This tree, of compact, rich, dark-green foliage, is the very beauty of symmetry and elegance. It is of rapid growth, making 18 inches to 2 feet in diameter and 75 feet high in 25 years, making 50 to 100 cords of wood to the acre — of this I speak from personal experience — and in a few hundred to probably a thousand years attaining a maximum growth of from 6 to 16 feet in diameter, and 250 to 350 feet and more in height, frequently being over 150 feet to the first limb. Is it too much to say that such trees will make 10,000 to 40,000 feet of lumber to the tree, or 10 to 40 cords of wood? We have thousands of square miles that will yield from 50,000 to 100,000 feet, with a maximum of 500,000 feet per acre, and 200 to 600 cords of wood, with a maximum of 1,500 cords and more per acre. These figures are all within the limit of actual experience.

In answer to an inquiry with regard to spars and piling, a timber dealer answers me: "In spars I will contract any number wanted, 18 to 27 inches at the butt, 12 to 15 at the top, and 100 feet long. Piling, any amount, size and in length to suit you." To show those who come in after times the kind of forest Portland and suburbs were built in, I have reserved on my ground 14 trees, six of which stand on an area of 12 by 25 feet, and average five feet in diameter and 200 feet in height, one being seven feet in diameter and higher. These were our ordinary trees, of which I counted 250 on one acre in my dooryard, one of which made 30 cords of wood. To those interested, I extend an invitation to call and see specimens of 26 varieties of our *Coniferæ* in their habitat. The terms red and yellow fir, which designate a reddish fibred, rather coarse-grained lumber, and a finer fibred, hard, compact, yellow grained lumber of superior quality, are commonly supposed to designate two distinct varieties; but close observation of botanists has decided that this is not the case, and there is but one variety of Douglass fir; and that while red and and yellow generally applies to different trees of this variety, from some mysterious and unknown cause in their growth, yet both red and yellow fir are found in the same tree. As stated, the yellow fir is more compact, finer grained, of greater strength and more durable, and for ship-building, bridge work, railroading, spars and piling, and all structured works requiring great length and strength of timbers, there is nothing equal to it. Did time permit, it would be interesting to follow up the scientific tests made by the government and railroads which have led to this conclusion; but for the present suffice it to say that the matter is settled and being acted upon. Few of us fully appreciate the commercial importance and pecuniary magnitude of this fact. To emphasize this I quote from the Chicago Northwestern Lumberman and letters received by the Pacific Pine Lumber Company. Referring to the tests of the Northern Pacific Railroad, the Lumberman says: —

"These experiments, it must be remembered, were made by the officials of the Northern Pacific Railroad for their own purposes in connection with the construction department, and without any intention of having them published. They were not made with any idea of booming fir lumber, but because there had been statements made that 'fir was not as good as oak for bridge purposes, that it would not stand the same strain, and that therefore it would be better to use oak, even if they had to import it.' On this account they are the more valuable. The tests made are decisive on the question of strength, both tensile and compressive. The tenacity of fir is phenomenal, and is equaled by no other wood."

From letters to the Pacific Pine Lumber Company, I quote as follows:—

"*E. M. Herrick, Esq., President Pacific Pine Lumber Company*—

"DEAR SIR: In reply to yours of April 8, in relation to Puget sound pine—Oregon fir—say: We have used it extensively in constructing our bridges, buildings and other structures of the Southern Pacific Railroad Company, and for such purposes we consider it among the best timbers in the world, as it can be had any length or size.

"The following data is in regard to ultimate strength of Oregon pine (or Douglass fir), as per average of experiments made by us: Tensile, 15,900 pounds per square inch; crushing, 6,000 pounds per square inch; transverse, 13,630 pounds per square inch; shearing with the grain, 600 pounds per square inch; modulus of elasticity, 1,272,000 pounds per square inch.

"ARTHUR BROWN,

"Supt. bridge and building department Southern Pacific R. R. Co."

"*E. M. Herrick, Esq., president Pacific Pine Lumber Company*—

"DEAR SIR: In reply to yours of the 12th instant, would say that I have found Oregon fir an excellent material for ship-building, both for its strength and durability. Twenty-two years since, I was one of a committee of surveyors appointed by a board of underwriters to examine the oldest vessels on this coast built of Douglass fir. We found them generally sound, and the iron well preserved with the gum and pitch of the wood. Among the vessels then examined was the large brig Arago, then seven years old, and found sound, except where water had been leaking from a tank. The same vessel is now in good condition, and an insurable risk. The bark Wildwood, 1,100 tons, was built of Douglass fir in 1871, and was thoroughly opened by the Veritas and Record inspectors of Boston, in 1871; found sound, and class continued 33 L11 for two years in the former, and A1 for four years in the latter. Said bark is now eighteen years old, and shows no sign of gauge or work. I think she is the strongest and best wooden vessel of her age belonging on this coast. Much more could be said in favor of the wood named, but I deem it unnecessary, as its excellent qualities are so well known in our country.

"C. L. TAYLOR."

"*E. M. Herrick, Esq., president Pacific Pine Lumber Company*—

"DEAR SIR: In regard to your inquiry regarding yellow fir, or as more commonly known, Oregon pine, we would say: We have used it in our business of ship-building for the past thirty years. In that time we have built over seventy vessels, using in their construction almost exclusively the yellow fir. In no case has it failed to meet all requirements for strength, elasticity and durability.

"The schooner Union, built by us in 1859, and now owned in Mexico, was at San Francisco a short time since for repairs. She was found to be as sound as when built. The Ellen-Adelia, built in 1863, and in constant use for twenty-five years, received a thorough overhauling. Every timber and plank in her proved to be in as good condition as when she left the ways. We know of no other wood that is the equal of yellow fir for ceiling, planking, deckframe, deckplank and spars. Its great size, and the long lengths in which it can be obtained, coupled with its adaptability for holding calking, render it almost invaluable to the shipbuilder.

"HALL BROTHERS."

"*Pacific Pine Lumber Company, San Francisco, California*—

"GENTLEMEN: Replying to your question as to opinion of Douglass fir, or Oregon pine, as a structural material, we are much pleased to be able to state our conviction that no timber obtainable in abundance in the United States can compare with it in strength and lightness combined, and therefore in suitability for engineering structures.

"The long-leaf southern pine (yellow fir) of the Atlantic coast and the white oak are the only considerable timbers approaching Douglass fir in strength, independent of self-support, and as both weigh at least 30 per cent. more than fir, the latter is left unrivaled in quality, as it is, beyond doubt, in the extent of obtainable dimensions. We will take pleasure in furnishing you with data and drawings illustrating our practice in the use of this wonderful timber.

"SAN FRANCISCO BRIDGE COMPANY,
"Per H. S. WOOD, chief engineer."

"*Pacific Pine Lumber Company, San Francisco, California*—

"GENTLEMEN: In reply to your inquiry concerning our experience in the use of Oregon pine, or Douglass fir, we are pleased to say that we have used that timber (as well as all the other varieties of timber generally in use) for the past sixteen years, in all kinds of railroad and highway bridging, both in trusses, where the timber is subjected to heavy tensile and compressive strains, and in floor systems, where the timber must sustain the heaviest of transverse strains, and have also used the timber in various forms of structural woodwork; and we are free to say that, in our opinion, for all such work it is the best in use. Its well-known qualities of straightness of grain,

freedom from 'dozy' or weak places, and the remarkable toughness of fibre, make it peculiarly well adapted to our use. We have seen nothing in American or foreign woods applicable to bridge and other frame construction which is superior to it in economy of working, in strength, or in durability under strain.

"ALFRED W. BURRELL,

"President California Bridge Company."

Another consideration of importance and inestimable value to the future of our state, is the climatic influences and horticultural aspect of this subject, of which I shall write at another time.

The value to the state of this vast forest area in its modifying influence in preventing those sudden and violent climatic changes common to treeless regions, and in the prevention of droughts and disastrous floods in the conservation of the rainfall, which, being held in the leafy mold and cool, shaded forest soil, slowly percolates through the highlands in springs and gentle rivulets to the valleys below, filling the earth with moisture and furnishing a perennial supply of crystal, pure water, alike necessary for plant and animal life, form a grand system of subirrigation which has made this the land of never failing crops. We are fortunate in the fact that for a long time vast areas of mountain heights of these wooded lands will be inaccessible to the lumberman, and let us hope that in the meantime the government will see the importance of making the necessary forest reserve to secure us against the disastrous results of forest denudation.

THE STRINGFELLOW METHOD OF SHORT-ROOT PRUNING.

By Henry E. Dosch.

You can help your fellow-man; you must help your fellow-man. It is a duty, nay, even a divine privilege to lighten the burden of our fellow laborers, by giving them the results of our best thoughts and experience.

Some five years ago my attention was called to this new method of root-pruning in planting trees. I was incredulous, as it upset all time-honored teachings; yet as the article in question was from the pen of such a man as J. H. Hale, the celebrated Connecticut peach-grower, saying that he had just planted 100,000 peach trees in his Georgia orchard in that way, I had to take it for granted that the Stringfellow method was a correct one; however, before giving my own experiments in that direction, allow me to quote from Bulletin No. 98, Alabama agricultural experiment station, which says:—

"The method of pruning away practically all the roots of a young tree before planting it, leaving only short stubs half an inch long or less, seems to be finding an increasing number of advocates. This new method runs so exactly counter to the established practice and teaching of generations of orchardists and nurserymen that conservative people find it difficult to believe the favorable reports of it that they see in print. Having been taught all our lives the necessity for keeping the root system of the young tree as nearly intact as possible when moving it from the nursery to the orchard, it gives one a shock to be told that it would be better to cut it away entirely. The advocates of this system claim that with trees so treated the new roots, springing direct from the crown and from the short stubs, assume a more natural position and strike down more deeply into the soil than when trees are planted the usual way; and that consequently the tree is more vigorous and longer lived. Second, they point to the undoubted fact that the new plan is much the cheaper. Less care would be required in digging the trees in the nursery; a good share of the top and roots could be cut away before shipping, thus saving in boxing and freights; and finally the digging of large holes could be dispensed with, and in properly prepared soil the tree, whittled to a neat stub, could be simply shoved into the ground, or planted in a dibble hole, like a cutting.

"This system of planting originated on the gulf coast of Texas and has been most extensively practiced there. Being familiar with gulf coast soils and knowing their soft, moist character and great drought-resisting capacity, and their especial adaptability to the growth of all kinds of cuttings, my own opinion was that most of the successes reported with short-root pruning were due to the character of the soil, and that it would be likely to fail disastrously on hard and clayey or droughty land.

"In planting some pears and peaches during February, 1896, it was determined to try the experiment. In two rows each of pears and peaches, running twenty-four trees to the row, half the trees were root-pruned, leaving stubs less than half an inch long. The others were planted in the usual way, alternating three of the root-pruned and three not root-pruned trees. The peaches were Lady Ingold, Hale's Early, Alexander, Elberta, Tillotson, Early Crawford, Mountain Rose and Stump. The pears were Bartlett on French roots, Bartlett on Japanese roots and Keiffer on Japanese roots. All were well grown one-year-olds. The soil was a hard, gravelly hillside, with stiff clay subsoil, and so poor and droughty that it only made five bushels of corn to the acre the previous season. No more trying condition could be conceived for the test, and it was with many misgivings that the carefully whittled stubs, looking like inverted walking canes, were planted in such uncongenial surroundings. All, of course, were fertilized and cultivated alike. To add to the severity of the test a drought set in early in April, with unseasonable heat, lasting till the first week in June.

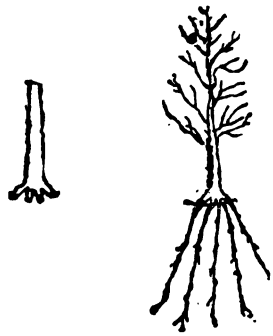
"On April 15 it was noted that the root-pruned trees were starting much more feebly and slowly than the others, but by April 27 they had fully caught up, and from that day to this the closest inspection has failed to detect any difference between them. One peach tree from the pruned and one from the unpruned lots have died. The pears are a perfect stand. Certainly so far no increased vigor has been observed in the root-pruned trees, but on the other hand no disadvantage can be detected, and the conditions could hardly have been more severe. What the final difference will be, if any, on the health and longevity of the trees, of course, remains to be seen."

In further explanation permit me to give a letter from Mr. Stringfellow himself. He says:—

"While several orchards in Galveston county have been demonstrating for five or six years the great superiority of my method of root-pruning trees before planting, the remarkable experience of Mr. J. H. Hale, the great Connecticut peach-grower, seems to warrant a presentation of the subject to your readers also. As soon as the methods and reasons for it were suggested to him several years ago, he saw its truth. Without waiting for the slow demonstration of experience he at once put it in practice on his great 900-acre peach orchard of 100,000 trees, which he was about to

plant in Georgia. In reply to a recent letter of inquiry from me he tells how they turned out:—

'*H. M. Stringfellow*—



ROOT PRUNED WHEN SET. ROOT PRUNED END FIRST YEAR.

'DEAR SIR: I am glad to state that the close-root pruning which was practiced when planting our entire orchard or 100,000 trees at Fort Valley, Georgia, proved to be the most successful operation we ever practiced, less than one-half of one per cent. of the trees failing to grow, and all making the most vigorous and uniform growth I have ever seen in any orchard in America. The orchard is now three years old, and gave us an enormous crop of superb fruit this past season. I am thoroughly in favor of this system of root-pruning.' This method, which I hit upon eight years ago, is simply copying nature. She starts her trees from seeds with neither tops or roots, and universal experience has shown that these and trees grown from cuttings (which are practically seed), if never moved, are the strongest, healthiest, long-lived and most productive.

"A root-pruned tree is actually superior to a seedling, in that it strikes several deep, penetrating roots instead of one. A tree planted with long roots will invariably reëstablish itself by sending out fibrous ones from the old roots, and result in a permanently lateral and surface-rooted system. But besides giving better trees, this method has the following further advantages:—

"*First*—A great saving in the digging of all trees. *Second*—An equal saving of labor and material in the packing. *Third*—A still greater saving to the buyers. Hundreds of thousands of dollars are annually paid to railroads in charges on extra weight of bagging, moss, boxes and worse than useless tops and roots. *Fourth*—Thousands of dollars will be saved in the planting. No need of two-foot holes and spreading out of roots by hand. On well-prepared ground, simply stretch a strong line with tags tied at the desired intervals, make a small hole with a dibble the proper depth, insert the tree and tramp well. Or, as Mr. Hale did, sink a spade, push the handle back far enough to allow of inserting the tree behind, withdraw the spade and press firmly with the foot. *Fifth*—Another most important advantage is that by this method we reduce to a minimum the danger of spreading all kinds of insect pests and diseases, such as scales, root lice, black knot, root rot, etc. These are mostly found on the tops and long roots. Finally, root-pruning insures a most uniform and almost certain growth, and the drier the country the greater the need for it. Such a tree will grow off just as readily and strike roots a foot or more deep in thirty

days after growth starts. It is applicable to all ages and the older the tree the more necessary.

"*Directions.*—Hold the tree top-down and cut all roots back to about an inch, more or less, sloping the cuts so that when set the cut surface will face down, the strong roots perpendicularly to the plane or surface of the cut. This final pruning should be done shortly before planting, so as to present a fresh surface for the callus to form. If trees are to be kept some time or shipped, leave about two inches of roots, the planter to cut back when the tree is set. About one foot of top should be left; more or less makes no great difference. If well staked, three or four feet may be left, but it is best to cut back close to avoid staking and secure a new straight stem. Let all shoots grow until a foot or so long, when the best should be kept and all others rubbed off. Generally a much better growth is shown the first year, but the second and ever after, the root-pruned tree will show a wonderful superiority.

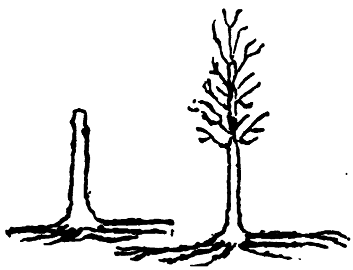
"H. M. STRINGFELLOW."

At the fruit-growers' convention held at La Fayette, in the summer of 1895, I called attention to this method and urged the fruit-growers to experiment along this line, and report results at some future meeting, but the very idea was hooted at by our most advanced horticulturists and nurserymen, and I dropped the matter, having resolved, however, to give the method a thorough trial myself and prove either its correctness or failure, under our climatic and soil conditions. For this purpose I procured fifty trees, one, two and three years old, of pears, apples, prunes, plums and cherries, grafted on different varieties of roots. I did this to give the method a thorough and complete trial, and if possible see if one or the other roots would do better, and also if the age of the trees made any difference. I then cut away every root, leaving but three inches—less would have been better—on the stub and removing even every little fibre, so they were perfectly bare; the tops were cut off to thirty inches in height, all alike, and planted in two rows three feet apart in the row and five feet between rows. Of course, if planted for orchard, they would have to be the regular distances apart, but I was only experimenting, intending to remove them when the experiment had been concluded.

The first year the trees made but few inches growth, which I attributed, and correctly so, to the fact that the trees were growing roots; yet, I had my fears, as my soil is a heavy, stubborn, clay soil, underlaid with hardpan, and a very dry season followed. I cultivated and hoed them, the same as I would have done if planted in the orchard, but when fall came I had about reached the conclusion it was a failure and paid no further attention to them. The following spring, when preparing my garden in which these trees were planted, I started to pull them up, when, to my surprise, I could not do it; upon examining the little things, I noticed the buds were swell-

ing, showing life in all but two three-year-old Italian prune trees, grafted on peach roots, which were dead. I then concluded to allow the trees to remain and again gave them the same cultivation and hoeing as the year before, and when they began to grow I thought they never would stop; the prune trees grew eight feet and the apple and pear trees three and four feet, respectively.

The fruit-growers' convention met that year in July at Newberg, to which I took a number of these trees, to show the results of my experiment, and naturally, like myself, every fruit-grower present was very much astonished, and the proofs admitted of no argument. The most surprising fact of all was not the large top growth these trees made, but the perfect root system they had formed. We all know that most nursery trees have one-sided roots, difficult to replant and in our clay soils spread out close to the surface in growing and are constantly torn by the plow, producing innumerable sprouts. In the Stringfellow method this is all changed; the pruned stubs throw out three to four strong roots from each stub, which strikes diagonally down into the soil. (See cut I.) Those which I dug to exhibit at Newberg had grown roots down into this heavy, clay soil over four feet, even penetrating into the hardpan, with hundreds of lateral rootlets, but none grew near the surface, hence out of reach of the plow. A more perfect and symmetrical root system could not be formed. I am confident that if plum stock is used for our prune trees, care being taken to cut away the buds at the union when pruning the roots for planting under this system, no sprouting will follow, and thus eliminate the principal objection to the use of plum stock for prunes, which stock is conceded to be the hardiest, natural and most suitable for our moist, clay soils. No sprouts occurred on those trees I experimented with, treated in this manner.



LONG ROOT TREE WHEN SET. LONG ROOT TREE END FIRST YEAR.

As to what age tree is best adapted for this method of planting, I could see no difference whatever; the three-year-old trees making the same perfect root system as the one or two-year-old trees, nor was there any difference as to the roots on which they were grafted. The only difference I could observe was that the three-year-old pear and cherry trees set some fruit, which matured nicely. However, I do not regard this of any advantage, as I do not think trees should be allowed to bear fruit too young.

In my paper on "Horticulture and its Requisites," which appears in another part of this report (see page 222), I explained the old method of planting trees minutely, and which article was written before my experiments spoken of in this direction were made. However, I would say that if I were to plant a new orchard now, I would certainly use the Stringfellow

method of root-pruning, except as to nut-bearing trees, because these trees have a large taproot and very few lateral roots. Experiments have proven that if this taproot is cut off the tree will immediately grow another one, and sometimes even two or three, which is too heavy a tax on the vitality of these trees; in consequence, many fail to live, hence in planting nut-bearing trees it is best to follow nature's method; plant the nuts of proper variety and generation where the tree is to grow, or if planting young trees follow the methods described in a paper on "Nut Culture" in another part of this report (see page 502).

In conclusion, I would again earnestly request fruit-growers to experiment along this line in different sections of our state as well as on the various soils and report results through the horticultural press.

THE HOP CROP AND ITS VALUE.

By John Minto.

Without converting or offering views in opposition to others on questions of preference as to whether fruit or hop-culture offers greatest inducements of profit to those wishing to employ their labor on the land to secure from it the richest returns, I have come to regard hop-culture, for the care and skill required for success in producing the crop of the first quality and value when produced, as classing it more properly as an horticultural than an agricultural crop.

There are so many influences that militate against success with a hop crop that I can recognize the truth of a remark once made to me by a friend, "That one crop a hop-grower could always depend upon, and that was a crop of disappointment." This has led me since to endeavor to find the causes leading to such a conclusion. I think now that disappointments in hop-farming result largely from entering upon hop-culture without apprehension of the capital required to harvest the crop in the best manner. After industry has been used with no little care and skill to bring the crop ready for the harvest, a few days of unfavorable weather, a lack of care and skill in picking, drying and pressing will all tend to make the crop one of disappointment.

THE HOP CROP OF OREGON FOR 1898.

Careful estimates of men whose business it is to know, places the Oregon hop crop for 1898 at 67,500 bales of 180 pounds net weight. At an average value of 13½ cents per pound, this is $1,640,250. The crop was of better quality with less defective hops picked than for several years previous, partly as a result of a favorable season and partly as a result of more intelligent management.

Some growers have, or think they have found that land may be too rich for hops under ordinary methods of management. It is very generally believed that land which can be relied upon to produce a large crop of wheat can be counted on to produce good hops, and this is perhaps generally true. And in practice it is found the land which is too rich and moist to produce the best quality of wheat will produce too rank a growth of hops, if not managed so as to avoid overgrowth. With owners of yards on such lands it is not the largest yield that is sought, but the cleanest, most early and evenly ripened. The writer has had opportunity to study the growth of

hops for the past four years on land whereon over-production is a danger. It is on alluvial soil, commonly called river bottom land — the most natural, perhaps, for the hop plant. At all events, there are owners who claim they can produce 2,500 pounds per acre on such lands, but deem 1,500 to 1,800 pounds a safer crop for quality and cleanness. The first crop grown on this particular yard of (then) 35 acres was so remarkable as a yield of baby hops as to secure great numbers of visitors between the forming and ripening of the crop, which was so heavy with foliage and hops as to make it impossible to reach vermin with spray after they got a lodgment, which they did, with the result that not one fourth of the yard was touched by the pickers, and such hops as were picked did not sell for enough to pay the pickers. Three vines had been trained to each pole.

For the succeeding crop the yard was reduced to less than 25 acres, and the rule of two vines to each pole was adopted. The growth of foliage was still too heavy. Three fifths of the yard was picked over, and 121 bales saved, which sold for 9½ cents per pound — not enough to pay. The third season, one vine to the pole was the rule,— transgressed sometimes by the ignorance of the workmen. The crop was a remarkable one, chiefly for the great proportion of hops to foliage; 223 bales were picked, the net weight of hops being 42,702 pounds. The crop sold for $5,890.18, which, after paying indebtedness against the yard and buildings brought forward from former years, and working expenses, supplies, insurance, etc., left $688.67 for the four years' use of the land and plant.

The condition of a hop yard during the growing season demands the daily attention of its manager, and he should have at command all the assistance necessary to insure the best conditions from day to day. The experiences of the season of 1898, being drier than for several years, caused diminished yields on many yards from lack of moisture which more thorough working of soil should have secured. Some care and inquiry as to what portion of the season is best to secure the best results from cultivation, leads to the conclusion that early cultivation is best. The owner of the best conditioned yard visited begins cultivation in February and stops, leaving his ground level and in fine tilth, when the vines reach the tops of the poles, or to hanging wires, if those be used. From that stage of growth until the pickers enter the yard the most dreaded influence is the invasion of the mother of the hop aphis. There is great diversity of opinion among growers as to the benefit of spraying, but scientists and hop-buying agents who watch the growing crops generally strongly favor spraying. It was near the middle of July when the aphis appeared in 1898 on the yard under my observation. It was observed also that the ladybird bugs were more plentiful than usual, and some hesitation in regard to spraying was felt, though not mentioned in the letter to Professor Cordley. His answer gives information on that point, and promises more, for which reason I insert it here:—

"CORVALLIS, Oregon, July 12, 1898.

"*Mr. John Minto*—

"DEAR SIR: Vacation or no vacation, I am always glad to hear from Mr. Minto; and now, in answer to your letter of the 11th instant, will say that I have great faith in early spraying of hop vines. In general, growers are disposed to wait until the aphis becomes very bad before resorting to the use of a spray pump. The result is that if the weather is favorable for the multiplication of lice, even the spray pump, intelligently and faithfully used, fails to hold them in check and the crop is injured, or even lost, while if the application had been made at the proper time, much more satisfactory results would have been secured.

"The winged females of the hop aphis migrate from prunes and plums to the hop about June 1, and then give birth to a brood of wingless hop lice, and it is from the few individuals of this brood that all the lice in that yard for that season must come—*i. e.*, after the spring migration of winged females is over, which is not later than June 15 at the outside, there can be no infestation of the yard from outside sources. It therefore follows that if by early spraying, between June 20 and July 1, we can destroy the individuals of the first brood, there can be no great development of lice during the rest of the season. Of course, it will be said that at this time the lice are always very scarce, and that one cannot tell whether they will be abundant enough to do any damage during the season or not, which is all very true. However, one must bear in mind that a very few lice upon each hill in June, under favorable conditions, may become an immense nest in August or September, whereas if the few are killed in June, the subsequent hosts will certainly fail to materialize.

"Now as to whether you should spray your yard now or not, I cannot say. It depends upon the number of lice present on each vine, and upon the parasite which may also be present. I do not think that the spray will injure the pollen. But I have been through all the yards in this vicinity, and I do not think it is necessary that they be sprayed. I have reached this conclusion from observing two facts: *First*, the extreme scarcity of the hop lice, nine tenths of the vines having absolutely none. *Second*, the abundance of parasites of the lice. I verily believe that in the yards that I have visited there are at least a half dozen parasites for each hop aphis. Whether the above fortunate state of affairs is present in other localities or not, I do not know. If not, spraying is undoubtedly advisable, although it is now somewhat late; but with us, I am certain that at present spraying would do more harm than good, since it would kill far more parasites than hop lice.

"The wheat aphis, contrary to the generally accepted idea, is not identical with the hop aphis. In fact, they are as distinct as are the sheep and the cow, belonging as they do, to entirely separate genera. The wheat aphis is *Siphonophora avenæ*, while the hop aphis is *Phorodon humuli*.

"Very truly,

"A. B. CORDLEY."

A subsequent note informs me that Professor Cordley intends to have engravings of these parasites of the hop lice for use in illustrated lectures, in order to enable fruit and hop-growers to know their friends when they see them. During the hop harvest I had an opportunity to examine a few hops showing mold, in two different yards, upon which the parasite of the hop lice were numerous and active. In one case I noticed four different markings of the ladybird.

There has appeared within the past four years an enemy to the hop plant which does its work below the surface of the ground—a small grub or worm which eats into the center of the roots, near the crown, and destroys them. The injury done by this worm is most manifest in old yards on heavy clay loam soils, and on the more wet portions of such yards. Whether this worm or grub is the cause of the destruction which is becoming serious in some yards, or is an effect of causes like ill-drainage effecting the health of the roots, is not ascertained. Growers who have watched the increase of this enemy of the hop plant believe that yards subject to winter overflow of a stream are thereby protected from it, and deem river bottom lands best for hop yards for that reason.

The writer, who has for the past four years taken some trouble to find out where the best quality of hops are grown, has to acknowledge being without a settled belief on that point, having examined yards on alluvial land, on bench land bordering a stream above overflow, on plain land, and on the northern slopes of hills 500 to 600 feet above sea level, and found them bearing heavy crops in first-class condition, but in every case a land naturally well-drained. I believe, however, there is no special line of industry in Oregon that more requires a general conference or convention of those engaged in it than that of hop-growing.

In conclusion, this paper is not written to induce any person to engage in hop-culture to the abandonment of any line of industry more free from speculative chances than the hop trade. For ten years past there has never been a reliable certainty as to price a crop of hops would bring the producer until the sum total of the product of all hop-growing countries was ascertained and compared with the demand. For nearly or quite as long a good crop in all the hop-growing countries would be more than the demand called for, and profit, which is not certain to an Oregon grower at less than 10 cents per pound, was not realized.

ESTIMATED COST OF AN ORCHARD.

As there has been a great demand on this office from parties who contemplate planting orchards, for information as to the cost and getting it into bearing condition, and the income that may be expected during that period, steps were taken to get as much reliable information as possible on the subject. Many of our oldest and most reliable fruit-growers were asked to give the cost and product of their orchards up to the eighth year. It will be seen from the estimates given that the cost and product varies considerably. This is accounted for by the fact that the price of land varies according to location and its condition when bought, and in some cases there is additional expense caused by subsoiling, more thorough preparation of the soil before planting, more careful selection of trees, more thorough cultivation and spraying, while some allow for a certain percentage of loss of trees and an occasional off year in bearing. Yet, by making due allowance for drawbacks, exercising the proper judgment in the selection of soil for the varieties to be planted, and giving the proper treatment to the orchard from the time it is planted, it will be seen that an orchard is a safe and profitable investment. Carelessness in any branch will not pay in orchard work. Business principles must be employed in every department. The following estimates include the cost up to the seventh year, or when the trees have six years' bearing wood:—

COST OF A PEACH ORCHARD NEAR ASHLAND.

By Max Pracht, Ashland.

As regards the cost and care of an orchard to the age of seven years, I beg to say that my own experience as to the cost is not a true criterion, from the fact that for five years after setting out, my orchard was cared for by persons employed by me, but working under my orders, while I was engaged in other occupations. I will give you, however, a very nearly accurate estimate of the cost of a peach orchard, taking the ground in the brush and until it comes to profitable bearing, which by my method of cutting back is not until the fifth year after setting out, or say six years from the bud. Good peach soil is light, porous, marly, warm and easily cultivated land, neither springy nor boggy, such as our decomposed granite, and must be a sloping hillside, with an exposure to any point of the compass, except due west, or proportionately such as veer west from north or south. The best

range is from northeast to south, at least such is my experience here. Having selected the location, choosing—

Land, per acre	$	100 00
Cost for clearing and grubbing, per acre		30 00
Cost for plowing and subsoiling, per acre		5 00
Cost for laying out and digging holes, per acre		8 00
Cost for trees and setting out		20 00
Cost for pruning and shaping, first year		1 00
Cost for fence around orchard must be added, varying with the style of fence and size and shape of orchard, estimated at		16 00
Total cost, at the end of the first year	$	180 00
SECOND YEAR.		
Amount forward	$	180 00
Plowing, cultivating and pruning, per acre		10 00
Replacing sickly or ill-shaped trees, per acre		2 00
Digging for and exterminating borers		1 00
Interest at 10 per cent. on $180		18 00
Total cost, end of second year	$	211 00
THIRD YEAR.		
Amount forward	$	211 00
Plowing, cultivating and pruning		10 00
Replacing sickly trees, etc		1 00
Digging borers		1 00
Interest at 10 per cent. on $211		21 00
Total cost, end of third year	$	244 00
FOURTH YEAR.		
Amount forward	$	244 00
Plowing, cultivating and pruning		10 00
Digging for borers		1 00
Interest at 10 per cent. on $244		24 40
Total cost, end of fourth year	$	279 40
FIFTH YEAR.		
Amount forward	$	279 40
Plowing, cultivating and pruning		10 00
Digging borers and slack-liming		5 00
Hand-thinning fruit		1 00
Interest on $279		27 90
Total cost, end of fifth year	$	323 30

We have now as the cost per acre of an orchard of not less than ten acres and in perfect condition at the end of the fifth year, the first year of market bearing, $323.30.

These trees should produce each an average of 20 pounds of marketable fruit, worth here not less than 2½ cents per pound, and up to 4½ cents, say 50 cents per tree, 160 to the acre, $80; culls for home consumption, $10; total revenue at end of first year, age of orchard five years, $90.

From this time on the annual increase of productive capacity may be rated at one box or 20 pounds per tree to the eighth year, when an orchard in prime condition should mature an average of 80 pounds or four boxes per tree; and with the trees one rod apart, properly dwarfed, this output should not be exceeded, so as to conserve the vigor and life of the tree; by which method in this locality a peach tree is good for twenty years of profitable life, and will bring at least $2 per year. From these estimates of

cost anyone can figure out the progressive cost of maintaining the orchard, figuring out the net profits at the end of each season. I have purposely omitted the item of taxes, as they vary much, but are not high.

During the fourth year, though no income from the sale of fruit is shown, there will be enough peaches, which may be safely left on the trees, for home consumption. The cost of picking, packing and marketing is not shown in the estimate, because the price named, *i. e.*, 2½ cents per pound, is a price at which prime fruit is always salable *on the tree* to first-class buyers who will harvest and market on their own account.

COST OF AN APPLE AND PRUNE ORCHARD NEAR GRANTS PASS.

By A. H. CARSON, Grants Pass, Oregon.

We have found in fifteen years' experience the following to be the cost of planting and caring for an orchard up to the seventh year:—

APPLES (1 ACRE).

Dr.

To plowing and preparing ground	$	3 00
To sixty-nine trees two years old at 12½ cents each (25 by 25 feet apart)		8 63
To one day's work planting and laying off ground		2 00
To cultivating and pruning seven years at $6		42 00
Total cost on one acre to seventh year	$	55 63

Cr.

By sixty-nine boxes of apples at 50 cents, up to seventh year		34 40
Net cost per acre	$	21 23

It is seen, from the foregoing, the profits of an apple orchard up to the seventh year are on the wrong side of the account, but we now have it at the age when it will begin to pay. The eighth year, if the trees are in good ground, they should produce four boxes of apples to the tree. As the orchard increases in age the expenses of cultivation, spraying and pruning increase; but if the orchard is cared for each year the maximum cost for cultivation, spraying and pruning will not be greater any year than $10 per acre. Then the maximum production of the orchard each year is hard to estimate, but after an apple orchard is nine years old, one year with another the average production would not be less than ten boxes per tree, or 690 boxes to the acre.

PRUNES (1 ACRE).

Dr.

To plowing land	$	3 00
To 180 trees, 20 by 20 feet apart, at 12½ cents		13 50
To laying off and planting the same		3 00
To cultivating and pruning the same for five years at $5		25 00
Cost of one acre at five years old	$	44 50
Curing prunes, including packing, drying and sacking, fifth year		27 00
	$	71 50

Cr.

By 2,160 pounds of dried prunes at 5 cents		108 00
Profit of fifth year	$	36 50

The sixth year the productive capacity of the prune tree will increase nearly 100 per cent.; the seventh year, 75 per cent.; the eighth year, 40 per cent., and at the ninth year it has reached its maximum. I have made no estimate of the original cost of the land. It is seen, from the foregoing, I have taken one acre as the basis. I made no allowance whatever for loss of trees, supposing every tree should grow, but the tree-grower should remember these losses always follow. Then, too, there are sometimes unfavorable seasons. As a safe estimate, allow five per cent. for loss of trees the first year from planting out, and two per cent. additional up to the fifth year, and it will not be too much; yet, with all these allowances, anyone who cares to follow out these figures will find, as an invesment, money can not be put into dirt that will yield larger gains than orchard work.

COST OF A PRUNE ORCHARD IN POLK COUNTY.

By JAMES R. SHEPARD, Zena, Oregon.

I estimate the cost of ten acres planted in prunes, twenty feet apart, under ordinary conditions, as follows:—

Dr.

One thousand one hundred yearling trees (one hundred and ten per acre) at 6 cents	$ 66 00
Preparation of land (plowing and cultivation)	20 00
Setting out one thousand one hundred trees (at one cent each)	11 00
Cultivation and care first year*	
Cultivation and care second year*	
Cultivation and care third year (no other crop)	30 00
Cultivation and care fourth, fifth, sixth, seventh years	120 00
	$ 247 00

Cr.

Fourth year one third bushel of prunes per tree at 60 cents per bushel, twenty by one hundred	$ 220 00
Fifth year one half bushel of prunes per tree at 60 cents per bushel, thirty by one hundred	330 00
Sixth year, a failure of crop.	
Seventh year, one bushel of prunes per tree, dried	1,100 00
	$ 1,650 00

In some instances these figures will be doubled. It will be observed my estimates are very conservative, and no one need do worse, provided he uses ordinary care and judgment; but very much depends on location, soil, etc. I think a net profit (after seven years of age) of $100 per acre is not at all an extravagant estimate at present prices, say 5 to 6 cents per pound.

An occasional off year must be reckoned on, say one in four for Italian and one in eight for Petite. Estimates of $300 to $500 per acre are misleading, I think, though much better has occasionally been done, under high prices and favorable conditions.

My estimate presupposes proper pruning. Where land is well cultivated, but no pruning is done, a bushel per tree the fourth year may be realized, but the tree is injured thereby.

*More than offset by potato or bean crop.

COST OF A PRUNE ORCHARD NEAR SALEM.

By R. D. Allen, Silverton, Oregon,

FIRST YEAR.

Cost of trees, per acre	$	10 00
Plowing ground one foot deep and subsoiling eight inches		4 00
Planting same		3 00
Harrowing and cultivating, eight times		2 40
Hoeing around trees		60
Total cost, first year	$	20 00

SECOND YEAR.

Interest on land at $50 per acre at ten per cent.	$	5 00
Interest, previous year's expenses, at ten per cent.		2 00
Plowing		3 00
Harrowing and cultivating, eight times		2 40
Hoeing around trees		60
Pruning and removing borers		1 00
Total cost, second year	$	14 00

THIRD YEAR.

Interest on land	$	5 00
Interest on expenses		3 40
Plowing		3 00
Harrowing and cultivating, eight times		2 40
Hoeing		1 00
Pruning and removing borers		1 50
Total cost, third year	$	16 30

FOURTH YEAR.

Interest on land	$	5 00
Interest on expenses		5 00
Plowing		3 00
Harrowing and cultivating		2 40
Hoeing		1 00
Pruning and removing borers		2 00
Total cost, fourth year	$	18 40

FIFTH YEAR.

Interest on land	$	5 00
Interest on expenses		6 87
Plowing		3 00
Harrowing and cultivating		2 40
Hoeing		1 00
Pruning and removing borers		2 00
Total cost, fifth year	$	20 27
Total cost for five years	$	88 97

The above is without the first cost of land and taxes being included.

COST OF AN ORCHARD NEAR NEWBERG.

By C. E. Hoskins, Springbrook, Oregon.

Much depends on the location, quality of soil and tools used in planting, cultivation, etc., of orchards as handled in Oregon. The difference between the owner and hired help would in many cases be 25 per cent.

EXPENSE BILL PER ACRE.

Plowing, subsoiling, cultivation, etc.	$	7 50
Trees, planting, cultivating, etc.		16 50
Second year cultivation		5 00
Third year cultivation, trimming, etc.		6 00

Fourth year cultivation, trimming, etc.	$ 7 00
Fifth year cultivation, trimming, etc.	8 00
Sixth year cultivation, trimming, etc.	8 00
Seventh year cultivation, trimming, etc.	8 00
Eighth year cultivation	8 00
Total	$ 74 00

AMOUNT OF FRUIT FROM ONE HUNDRED TREES—APPLES, PEARS, ETC.

Fifth year	1,500 pounds
Sixth year	3,000 pounds
Seventh year	6,000 to 9,000 pounds
Eighth year	12,000 to 15,000 pounds

PRUNES, PLUMS, ETC.

Fourth year	1,000 pounds
Fifth year	3,000 pounds
Sixth year	6,000 pounds
Seventh year	9,000 pounds
Eighth year	12,000 pounds

The above is without the original cost of land, interest, taxes, loss of trees, etc.

COST OF AN ORCHARD IN GRAND RONDE VALLEY.

By JAMES HENDERSHOTT, Cove, Oregon.

I can only approximate the cost, as I have never kept an expense bill. After planting, 5 cents per tree will cover all expenses up to four years old. After trees are four years old they will yield a profit to the grower. My prune trees are now twelve years old. They averaged this year 280 pounds. Peach plums, same age, averaged 320 pounds. Apples, same age, averaged 490 pounds.

The man who asserts his prunes produce 1,000 pounds to the tree, exaggerates for what money there is in it. If apples can be kept sound, they will pay 100 per cent. more than prunes.

LANDSCAPE GARDENING.

By J. C. C. Lewis, C. E.

In the very short time allotted me to write, I can give only a few salient points upon this most interesting subject—the subject least understood, and usually entirely unknown by the ordinary individual. Frequently, we observe a fine house with expensive adornment inside and out, but no pains whatever taken towards beautifying the grounds; or very unskillful efforts, if any are taken, go to render a more lamentable effect. Now, this is not right, for we build not only for comfort, but for pleasure as well, and we should cultivate a taste for the beautiful and for the eternal fitness of things; in other words, educate ourselves and others to be satisfied only with that which perfects, harmonizes and satisfies. Besides, it pays; for should we choose to part with property, if it is properly beautified its value is enhanced for more than the outlay.

The bane of landscape gardening is "too much shrubbery," the reason for which usually is that the architect employed has trees and shrubs to sell, coupled with the disposition of the owner to let his desires run riot in wild disorder, with the mistaken idea that he "won't do anything by halves."

The first step to be considered in landscape gardening is drainage, and it is the most essential one, especially when conditions are as we have them in the Willamette valley. Where the ground has little or no slope the tiling should not be more than 10 to 12 feet apart, increasing the distance one foot for each additional two degrees of pitch. These drains should be from two to four feet below the surface, and when trees of strong growth are used they should be judiciously placed in reference to drains. *All lawns should be underdrained.* Set that down as the first law of landscape gardening.

Another bane is the weed. The all important question is "How to eradicate, and then how to prevent them." And the wonder usually is, how they got in. The most common beginning of their foothold is from using barnyard manures, or chip manures raked from the alley or common woodyard. Another way of catching the infection is from the pasturing of stock, such as a pet cow or favorite horse, both disseminators of the weed pest. The wind also helps us to some of these bad neighbors, yet we may usually blame ourselves for the acquirement of most of our weeds through the

careless use of manures. Getting rid of them is the hardest problem, and to do so thoroughly there is but one way, and that is to burn off the sod and start everything anew and proceed somewhat as follows:—

First— Drain in a proper manner, then plow thoroughly, and be sure to have not less than five inches of good growing soil on top everywhere, eight inches is better, and from twelve to twenty inches of good soil where trees are to stand. A thorough plowing includes a subsoil, following then several courses with a heavy long-toothed harrow, to thoroughly pulverize the ground, and lastly fine down with a fine-toothed smoothing harrow. Right here let me say, watch your team while doing this work and promptly remove all droppings; thereby using the proverbial "ounce of preventative" in your campaign against the weed pest. In sowing, use a fine harrow, leaving enough to sink the seed about two inches, which will invariably insure a certain and strong "catch." Close the operation by rolling smoothly. By watching your team, using commercial fertilizers (where fertilizing is necessary), and sowing pure seed, your lawn will obtain a start comparatively free from weeds. The kind of seed is a matter of much consideration. Kentucky blue grass is a prime favorite with many, while others take to orchard grass straight or variously mixed. Any reliable seed man can, upon knowing your soil, give you the required information as to kind of seed necessary, also the quantity. Both depend upon the nature of the soil; therefore, I will not attempt any advice upon these two points. In Wisconsin, where I did considerable of this kind of work, I obtained the best results from a mixture put up by Peter Henderson, of Jersey City, New Jersey. I believe it is called "Central Park Lawn Mixture." It made a beautiful, firm, carpet-like growth in from seventy to one hundred days, owing to season and climatic influences, and also to the time of year in which the sowing is done. In Oregon, any month, excepting July and August will do to sow a lawn in. In some years, June or September may also prove objectionable. Top dressing of ground, bone or wood ashes is an excellent incentive to the growing lawn, or the two mixed is still better. This may be either raked in or rolled in. A spraying with liquid manure is best of all, but far more expensive.

"Anything worth doing at all is worth doing well," should be the motto of every lawn-grower, hence he must keep it down and tidy, and to this end the click of his mower should begin soon as the growth has attained about three inches, rather under than over, and keep it up each week. A neat lawn is "a joy forever," while one allowed to go to seed is unsightly and brands the owner as having "bitten off more than he can chew."

The lawn being properly propagated, its adornment may be subjected to the dictates of endless fancy, either nonsensical, barbarious, cranky, artistic, tasty, severe or comical. For my part, I admire the "tasty" adornment with few trees, say a French walnut, a mulberry for foliage, an elm or chestnut, two or three evergreens, a birch or laurel for its bark coloring and

a mountain ash, holly or larch for its burry show. For shrubs, our well-known Oregon grape, Wahoo or sumac are beauties. Then don't forget a lilac or snowball and roses, with here and there a flowerbed well and tastefully stocked, and at convenient bends of the walk be sure to place rustic seats, and if you can afford it indulge in a fountain aquarium. With regard to vases and statuary, I must say they have too funereal an aspect for my crude taste, and I would greatly prefer an old stump with clinging ivy or briar, not too conspicuous to be sure, or a quiet, reserved bit of rackery, unpainted, with natural moss upon. Furthermore, if there be a slight depression on the grounds, ravine or sink, by all means convert it into a fernery, the natural gem fancy of Oregon, and the most convenient to maintain.

As before stated, the owner's fancy should dictate and he be the judge of this embellishment of his lawn to the point of complete satisfaction upon his own part, whether the gardener is satisfied or not; but the latter can, by judicious suggestions, often persuade the proprietor of poor taste into doing about right and making a good showing after all.

In conclusion, do not allow any kind of trash to cumber the ground, as stones, chips, sticks, prunings, etc. A chip not larger than an inch square smothers several spears of growth; hence, it helps to disfigure. In case chip manure must be used it should be only the thoroughly rotted kind, which will easily pulverize, then you will not be bothered by small chips continually cropping out.

THE FOREST INTERESTS OF OREGON.

By John Minto.

Since, in obedience to the request of the board, the secretary compiled his report on the forest and arid land interests of the state, the influence which seemed to originate with the American Forestry Association, in favor of what its friends call a rational forestry policy, have been successful in beginning a systen of observation and care of the forest reserves proclaimed by President Cleveland.

From the general rule, excluding the ranging of livestock from the grass lands within these reserves, those of Oregon and Washington are exempted (tenatively at least) under a system of regulation of those using these pasture lands by the superintendents of the reserves. This regulation is a substantial good to the grazing interests using these pasture lands, in so far as stock-owners who take out grazing permits over defined bounds, respect the oonditions of the permit, conflicts for the grass will be lessened or entirely avoided. This may, and it is to be hoped will, lead to a respect for law in those thinly peopled districts. It will, also, not only diminish the possibility of forest fires from dry grass, but it will create a greater caution in regard to the use of fires in all forest lands by careless travelers or heedless summer recreationists, to whom most forest fires are traceable, to know that a national government has guards and watches over the public forests, whose duty it is to bring to punishment those who, from recklessness or malice, set out a forest fire. While, therefore, it is questionable whether it is properly a function of the national government to institute a police system over its lands, reserved because forest-covered within a state; whether indeed there is any such need of the national government interfering with the industries of the people, applied to the soil's resources in timber production more than other soil products, what has been done so far has had a very beneficial effect in bringing to the minds of citizens the immense wealth there is in the natural forests of the Pacific slope as a whole, and in Oregon as a richly endowed portion of it. As has been pointed out in the preceding report, the first estimate of the forest wealth of the state was from the pen of the commissioner at large of this board.

During the past two years, the secretary has been invited to write a brief paper on our forest wealth for the Arbor Day circular, issued by the superintendent of public instruction, and to give his views on the importance of

this resource in the short course of instruction adopted at the state agricultural college, at Corvallis, and at a teachers' institute held at Astoria.

But these means of creating a public interest, or even securing public attention, are slow and indefinite as compared with making a competitive exhibition of our timber resources, such as we had at Omaha, which not only resulted in securing to the name of the state more awards and diplomas than any other one state competing, but immediately increased the commerce in manufactured lumber between the cities of Portland and Omaha, to a value much greater than the cost of the exhibit during the time the exhibition was open. Such results seem to fully justify states like Oregon and Washington in making an exposition of the great resources of their forests that have waited until now for the world's market, and it would seem business wisdom that the state of Oregon should repeat, at the proposed exhibition at Philadelphia in 1899 and at Paris, France, in 1900, what she has done at Omaha. Meantime, the state should take the example set by the nation in the effort to protect this great resource of wealth from careless destruction. The law as it stands is deemed by many a good law, needing only someone especially charged with its enforcement. It is understood the citizens of Oregon, when receiving the liberal endowment gifts of public lands for endowment of their public schools, agricultural college and university, assumed the duty of protecting all property within the state, as well as promising not to interfere with the national government's disposal of the public domain within the state, by making a clear deed to a purchaser and not to oppress such purchaser by unequal taxation, if a nonresident, for which the state receives 5 per cent. of the net amount of sales as made, in addition to the present grants for educational, internal improvements and public building purposes. All arguments in support of a national forest reserve and protection policy have a quadruple strength in favor of state care and protection of forest lands against fire, under the fundamental bonds and ordinances admitting the state as part of the union. The former, however, has a relatively more important and nearer interest in the timber wealth as a means of support to a present and future population, for which reason the duty of using rational means of protection the more imperatively devolves upon the state than the nation, as the reasons for reserve of timber for national ship-building, which furnished reasons for the first reserve, have become obsolete, since the best warship has become an immense steel box, safest as a fighting machine with the least possible combustible material in or upon it.

Leaving the question of the best dividing line between the national and state's duties to be settled as they arise, the state yet has in its care, under its laws, three times the forest area to protect against fire that the nation has reserved in Oregon. And as the state is in duty bound to protect the proprietary rights of the nation within its boundaries as much as the property right of its citizens, it seems in this case a fit course for the law-making

power of the state to pursue, would be, wherever practicable, to coöperate with the nation in protecting the forests from destructive fires.

To effect this a few suggestions are submitted to legislators: *First*—Make it a duty under the law for the superintendent of schools in each county to have printed the laws of the nation and the state in regard to setting out forest fires in sufficient number of copies to have one in each schoolhouse in the county posted conspicuously. *Second*—Make it the duty of the clerk in each school district to apply to the county superintendent for copies of the law, national and state, against setting out forest fires, which the latter must keep posted in the schoolhouses of his district. *Third*—Make it the duty of the clerk of the school district to report the origin and amount of damage of any fire occurring in his district (if known) to the county superintendent of schools, to be by the latter reported to the county commissioners at their next meeting thereafter for record as county business, and the reasonable cost of both reports to be paid by the order of said court. *Fourth*—Make it the duty of the governor to appoint six active young men to act as forest wardens, one in each horticultural district of the state and one to act as chief forest warden, to receive the reports each warden shall make to him as to the number and effect of fires occurring in his district. Each of the forest wardens so appointed shall receive as compensation $75 per month while actually on duty as warden, who shall furnish himself what may be necessary for his travel within his district to prevent fires where possible; to aid and call on others to aid in putting out fire that has been started; to estimate and report such damage and use all honorable and lawful means to find out and bring to legal punishment any forest incendiary. Make it the duty of these forest wardens under the direction of the chief warden (who shall have the entire state as his field of duty) to begin on the first day of July annually and finish on the last day of September by reporting to the chief warden, who shall transmit said reports to the board of horticulture and through its office statements of time and claims of service, to the secretary of state for audit and allowance and to the governor the condition of the forests.

ORCHARD LANDS OF LONG AGO.

The orchard lands of long ago!
Oh, drowsy winds, awake and blow
The snowy blossoms back to me
And all the buds that used to be!
Blow back again the grassy ways,
Oh, truant feet, and lift the haze
Of happy summer from the trees
That trail their tresses in the seas
Of grain that float and overflow
The orchard lands of long ago!

Blow back the melody that slips
In lazy laughter from the lips
That marvel much that any kiss
Is sweeter than the apple is.
Blow back the twitter of the birds;
The lisp, the thrills and the words
Of merriment that found the shine
Of summertime a glorious wine
That drenched the leaves that loved it so
In orchard lands of long ago.

Oh, memory, alight and sing
Where round the rosy pippins cling
And golden russets glint and gleam
As in the old Arabian dream—
The fruits of that enchanted tree
The glad Aladdin robbed for me!
And drowsy winds, awake and fan
My blood as when it overran
A heart ripe as the apples grow
In orchard lands of long ago.

—James Whitcomb Riley.

ACKNOWLEDGMENTS.

Before closing this report we beg to acknowledge the many favors granted and the assistance given this board by others in carrying on this work. We realize that it would have been impossible to do the work that has been done without the hearty coöperation of others. Those to whom we are especially indebted for assistance and to whom we wish our appreciation of their valuable aid are: Quarantine Officer Alexander Craw, of San Francisco, the department of agriculture at Washington, D. C., and experiment stations of Ithaca, New York, New Jersey, California, Illinois and Oregon. To all local papers and the press throughout the state is due a great deal of praise for the earnestness with which they have assisted us in horticultural education, in placing before the public in a true light the results of our efforts in behalf of the fruit interests of the state, and to Henry E. Dosch for editing and compiling this our report.

J. R. CARDWELL,
President.

JOHN MINTO,
Secretary.

State of Oregon

SENATE JOINT RESOLUTION.

WHEREAS: The press of the State, by publishing the many instructive papers of Henry E. Dosch; in addition to his contributions to the Biennial Reports of the Board of Horticulture, the honors and thanks awarded him by the publication of addresses delivered upon invitation by the Dominion Fruit Growers Convention of British Columbia, and his more recent services under the auspices of the Portland Chamber of Commerce, in managing

THE OREGON EXHIBIT

at the recent Trans-Mississippi and International Exposition at Omaha, Nebraska, where by his great tact and energy the State of Oregon received honorable mention and valuable recognition for her almost limitless resources of field, forest and mine; as well as for the quality of her grain, fruit, fish, wool and lumber products; receiving, in recognition of their respective qualities, more important awards than was received by any other State, while extensively advertising the State and securing an immediate increase of exports of shingles, lumber and fruit from Portland, estimated at many times the cost of the exhibit, while it was being made: Therefore,

RESOLVED

That the thanks of the State of Oregon are hereby tendered

TO

Henry Ernst Dosch

for his services thus rendered, and that this action on the part of the Representatives of the people of Oregon be spread upon the journals of the House and Senate, respectively, and an engrossed copy thereof be mailed to Henry E. Dosch, by the chief clerks of the respective bodies.

Adopted by the Senate, January 30, 1899

Chief Clerk

President of the Senate

Concurred in by the House January 31, 1899

Chief Clerk

Speaker of the House

Approved February 6, 1899

Secretary

Governor

Secretary of State

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